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ABSTRACT

Volume II, Section C of a six-volume final report (which covers the findings of a research project on policy and technology related to rehabilitation of disabled individuals) presents a review of literature on six types of chronic disease disabilities--rheumatoid arthritis, coronary heart disease, emphysema, carcinoma of the colon/rectum, kidney disease, and diabetes mellitus. Individual chapters on each disability cover the following: definitions and classifications; prevalence, incidence, mortality, and cost estimates; demographic distribution; etiology; life functioning deficits in the areas of health, mobility, communication, cognitive-intellectual functioning, and social-attitudinal functioning; functioning as members of the community and labor force; technologies currently applied; and characteristics of the delivery system impacting the disability group. Bibliographies are also provided for each disability area. (SBH)

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HUMAN REHABILITATION TECHNIQUES

A Technology Assessment

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TEXAS TECH UNIVERSITY

Volume II
Part C

Supplemental Report:
Disability Analyses
Chronic Disease Disabilities

EC 104167

VOLUME 2

DISABILITY ANALYSES

VOLUME 2A - MOTOR DISABILITIES
VOLUME 2B - BEHAVIORAL DISABILITIES
VOLUME 2C - CHRONIC DISEASE DISABILITIES
VOLUME 2D - SENSES DISABILITIES

FOREWORD

This document is the second volume of the final report *Technology Assessment: Human Rehabilitation Techniques*, a project conducted at Texas Tech University by the Department of Industrial Engineering, the Research and Training Center in Mental Retardation, the Department of Systems, and the Technical and Professional Writing Program. The research has been conducted with the support of National Science Foundation grants ERP 75-10594 and ERP 75-10594 A01, monitored by the Directorate for Research Applications, Division of Exploratory Research and Systems Analysis.

Richard A. Dudek, Horn Professor and Chairman of the Department of Industrial Engineering has been a co-principal investigator and director of the project. Gerard J. Bensberg, Director of the Research and Training Center in Mental Retardation, and M. M. Ayoub, Professor of Industrial Engineering, have been co-principal investigators. Carol M. Sigelman and Andrew S. Martin of the Research and Training Center in Mental Retardation and Robert F. Powers of the Department of Industrial Engineering have been program managers for the project. James R. Burns and William M. Marcy of the Department of Systems have been in charge of the modeling used in the project. Technical writing has been performed by Charles W. Brewer and Cynthia E. Lyle of the Technical and Professional Writing Program. In addition, several research assistants and support personnel, as listed in the individual volumes of the study, have contributed to the project.

The project team wishes to acknowledge the efforts of individuals who have served on the Oversight Committee, Elizabeth Boggs, Kan Chen, Beatrix Cobb, Ronald Conley, Richard Herman, John Noble, Jr., Evan Vlachos, and Lester Wolcott; of Lee Phillips who served effectively as a program manager for a short time before leaving Texas Tech; of Brian Lambert who served as Work Session Conference Coordinator; of those who participated in the work-sessions chaired by Ted Hartman, David Malone, Blair Rowley, Evan Vlachos and John Wittman; and of Anne Seitz, the Secretary of the Project.

Although the National Science Foundation has supported this project, the findings, conclusions and recommendations expressed are those of the research team and do not necessarily reflect the views of NSF.

PREFACE

This volume is a supplement to the final report of the project "Technology Assessment: Human Rehabilitation Techniques." It includes reviews of the literature on 14 disabilities selected for intensive case study in the project. The contents of Volume 2 are as follows, with disabilities grouped on the basis of similarities of effects on functioning:

Section A--Motor Disabilities	
Stroke	Cathy Mannion
Spinal Cord Injury	Linda Vengroff
Cerebral Palsy	Cynthia Spanhel, Linda Vengroff
Section B--Behavioral Disabilities	
Epilepsy	Linda Vengroff, Melanie Schockett
Mental Retardation	Carol Sigelman, Linda Vengroff, Jerry Morris, Andrew Martin
Schizophrenia	Cynthia Spanhel, Melanie Schockett
Section C--Chronic Disease Disabilities	
Rheumatoid Arthritis	Cathy Mannion, Cynthia Spanhel
Coronary Heart Disease	Cathy Mannion
Emphysema	Jody Dixon
Carcinoma of the Colon/Rectum	Linda Vengroff
Kidney Disease	Cathy Mannion, Bernadette O'Farrell Ray, Linda Vengroff
Diabetes Mellitus	Linda Vengroff

Section D--Sensory Disabilities

Visual Impairment	Melanie Schockett
Hearing Impairment	Melanie Schockett

These 14 disabilities were selected because they are prevalent, result in severe limitation, are chronic rather than acute, have survivors in need of rehabilitation, and affect a broad range of ages. The current literature on each disability was reviewed to determine: (1) definitions and classifications; (2) prevalence, incidence, mortality, and cost estimates; (3) demographic distribution; (4) etiology; (5) life functioning deficits in the areas of health, mobility, communication, cognitive-intellectual functioning, and social attitudinal functioning; (6) functioning as members of the community and labor force; (7) technologies currently applied; and (8) characteristics of the service delivery system impacting the disability group. The review papers vary in thoroughness as a function of the state of the literature about each disability and differences among the researchers doing the literature review. They reflect a first attempt at the ambitious undertaking of analyzing diverse handicapping conditions within the same analytical framework. The disability reports included in this volume provided the raw material for the cross-disability analysis reported in Working Paper 3, "Life Functions: Scope of the Problem of Disability," and in the final report Volume 1.

VOLUME 2C

CHRONIC DISEASE DISABILITIES

TABLE OF CONTENTS

DISABILITY ANALYSIS: RHEUMATOID ARTHRITIS . . . . CHAPTER 1

Definitions 1-1

Societal Characteristics of Persons with Rheumatoid Arthritis 1-6

Demographics 1-13

Etiology 1-16

Life Functions 1-27

- Health 1-27
- Mobility 1-34
- Communication 1-36
- Social-Attitudinal 1-37
- Cognitive-Intellectual 1-40

Functioning as a Member of Society 1-41

Technologies 1-45

Bibliography 1-46

DISABILITY ANALYSIS: CORONARY HEART . . . . CHAPTER 2

Definition 2-1

Societal Characteristics of Persons with Coronary Heart Disease 2-3

Demographics 2-9

Etiology 2-10

Life Functions 2-15

- Mobility 2-22

DISABILITY ANALYSIS: CORONARY HEART (Continued) Chapter 2

    Health 2-23
    Communication 2-25
    Cognitive-Intellectual 2-25
    Social-Attitudinal 2-25

Functioning as a Member of Society 2-26

Technologies 2-30

Service Delivery 2-32

Bibliography 2-33

DISABILITY ANALYSIS: EMPHYSEMA Chapter 3

Definition 3-1

Societal Characteristics of Persons with Emphysema 3-4

Demographics 3-7

Etiology 3-8

Life Functions 3-12

    Mobility 3-13
    Health 3-15
    Communication 3-23
    Cognitive-Intellectual 3-24
    Social-Attitudinal 3-25

Functioning as a Member of Society 3-28

Technologies 3-30

Service Delivery 3-31

Bibliography 3-33

DISABILITY ANALYSIS: CARCINOMA OF THE COLON/RECTUM Chapter 4

Definition 4-1

Societal Characteristics of Persons with Colon/Rectum Cancer 4-3

DISABILITY ANALYSIS: CARCINOMA OF THE COLON/RECTUM (continued) Chapter 4

Demographics 4-7

Etiology 4-8

Life Functions 4-8

    Health 4-9
    Social-Attitudinal 4-16

Bibliography 4-18

DISABILITY ANALYSIS: KIDNEY DISEASE Chapter 5

Definition 5-1

Societal Characteristics of Persons with Kidney Disease 5-12

Demographics 5-20

Etiology 5-25

Life Functions 5-45

    Health 5-45
    Social-Attitudinal 5-56
    Mobility 5-63
    Cognitive-Intellectual 5-64
    Communication 5-64

Functioning as a Member of Society 5-67

Technologies 5-78

Service Delivery 5-87

Bibliography 5-90

DISABILITY ANALYSIS: DIABETES Chapter 6

Definition 6-1

Societal Characteristics of Diabetics 6-4

Demographics 6-11

Etiology 6-17

Life Functions 6-21

Health 6-21
Social-Attitudinal 6-29
Mobility 6-34
Cognitive-Intellectual 6-34

Functioning as a Member of Society 6-38

Technologies 6-43

Service Delivery 6-44

Bibliography 6-47

CHAPTER 1
DISABILITY ANALYSIS: RHEUMATOID ARTHRITIS

I. Definition

Dorland's Medical Dictionary defines arthritis as "an inflammation of a joint." The term is a popularly used label for many different conditions which may cause aching and pain in joints and connective tissues throughout the body regardless of underlying etiology.

The same source gives the following definition of rheumatism: "a disease marked by inflammation of the connective tissue structures of the body, especially the muscles and joints, by pain in these parts, by vegetations on the valves of the heart and by the presence of Aschoff bodies in the myocardium and skin." For our purpose, it is sufficient to consider rheumatism as a vague word used to label unexplained aches and pains in joints and muscles. Demonstrating the confusion created by labeling of rheumatic diseases, the Arthritis Foundation explains that people in Great Britain use "rheumatism" to include most forms of arthritis. In the United States "arthritis" is the more common term which is used to cover rheumatism as well as other conditions. (The Arthritis Foundation, 1966).

> Rheumatoid Arthritis (RA) is a chronic disease of the joints, usually polyarticular (affecting many joints), marked by inflammatory changes in the synovial membranes and articular structures and by atrophy and rarefaction (diminution in density and weight of the bones). In late stages deformity and ankylosis (abnormal immobility and consolidation of a joint) develop. Called also 'atrophic arthritis,' 'chronic infectious arthritis,' and 'proliferative arthritis' (Dorland's Illustrated Medical Dictionary).

Adams (1972) lists polyarthritis and rheumatoid arthritis as synonyms for rheumatoid arthritis.

Polyarthritis and Rheumatoid Arthritis are often used interchangeably in the literature. This usage is misleading as rheumatoid arthritis is a polyarthritis but polyarthritis also includes ankylosing spondylitis, psoriatic arthritis,plus other disorders. Polyarthritis is "an inflammation of several joints together" (Dorland's Medical Dictionary). LeRoy (1974, p.99) defines rheumatoid arthritis as "a generalized or systemic chronic inflammatory condition of unknown etiology whose distinctive features involve the musculoskeletal system with persistent and inflammatory arthritis."

Short (1974, p. 193) dates the introduction of the term rheumatoid arthritis into medical literature at 1859. Sir Alfred Baring Garrod, physician to the West London Hospital published "A Treatise on Rheumatism and Rheumatoid Arthritis" in 1890 in which he gives a clinical description of what is recognized today as rheumatoid arthritis. The first clear setting off of rheumatoid arthritis as a disease entity is generally acknowledged to be a doctoral thesis, presented August 3, 1800 by Augustin-Jacog Landre-Beauvais, french medical student . Possible earlier allusions to rheumatoid arthritis can be found in Thomas Sydenham's "Medical observations concerning the history and the cure of acute diseases" published in Latin (having been customarily translated from the English) which appeared in 1676.

Rheumatoid arthritis appears in all age groups. There is some dispute as to whether Juvenile Rheumatoid Arthritis (JRA) is a separate disease or just another form of rheumatoid arthritis in children. Still's Disease is generally equated with juvenile rheumatoid arthritis. Lichtenstein (1975) defined Still's Disease (JRA) as a chronic progressive polyarthritis in children, usually below the age of ten years, associated with generalized lymphadenopathy (inguinal, axillary, cervical, epitrochlear), and often fever, secondary anemia and splenomegaly. Boyle and Buchanan (1971, p. 198) use the following criteria of Ansell and Bywaters to establish the diagnosis of juvenile rheumatoid arthritis.

1. The disease must begin before the age of 16 years.
2. There should be inflammatory involvement of four or more joints for a minimum period of three months
3. If less than four joints are involved biopsy of the synovial changes compatible with rheumatoid arthritis and
4. Other causes of arthritis should be excluded

Two other disorders needing clarification are explained by Lichtenstein (1975):

Felty's Syndrome (rheumatoid arthritis with hyperspenism) is an old designation for rheumatoid arthritis in adults, associated with splenomegaly and leukopenia. Such patients usually have severe arthritic manifestations.

Psoriatic Arthritis. In approximately 3% of patients with severe rheumatoid arthritis, there appears to be a close relationship between psoriasis and arthritis. In such patients the exacerbations and remissions of the two diseases are likely to coincide, the distal inter-phalangeal joints are involved, and there is roentgenographic evidence of resorption of bone at the articular margins.

Diagnostic Criteria

Efforts to arrive at a definite diagnosis of rheumatoid arthritis led to the proposal of several diagnostic criteria. The most commonly used is the one of the subcommittee of the American Rheumatism Association (ARA) which is largely based on overt physical complaints and detection of internal changes associated with the condition. Table 1-1. Summarizes the ARA's diagnostic criteria.

TABLE 1-1
DIAGNOSTIC CRITERIA FOR RHEUMATOID ARTHRITIS

Classical Rheumatoid Arthritis. This diagnosis requires seven of the following criteria. In criteria 1 through 5 the joint signs and symptoms must be continuous for at least six weeks.

1. Morning stiffness.
2. Pain on motion or tenderness in at least one joint (observed by a physician).
3. Swelling (soft tissue thickening or fluid, not bony overgrowth alone) in at least one joint (observed by a physician).
4. Swelling (observed by a physician) of at least one other joint. (Any period free of joint symptoms between the two joint involvements may not be more than three months.)
5. Symmetrical joint swelling (observed by a physician) with simultaneous involvement of the same joint on both sides of the body. (Bilateral involvement of midphalangeal, metacarpophalangeal or metatarsophalangeal joints is acceptable with absolute symmetry.) Terminal phalangeal joint involvement will not satisfy this criterion.
6. Subcutaneous nodules (observed by a physician over bony prominences, on extensor surfaces or in juxtra-articular regions.
7. X-ray changes typical of rheumatoid arthritis (which must include at least bony decalcification localized to, or greatest around, the involved joints, and not just degenerative changes). Degenerative changes do not exclude patients from any group classified as rheumatoid arthritis.
8. Positive agglutination test--demonstration of the "rheumatoid factor" by any method which, in two laboratories, has been positive in not over 5 per cent of normal controls; or positive streptococcal agglutination test.
9. Poor mucin precipitate from synovial fluid (with shreds and cloudy solution).
10. Characteristic histologic changes in synovial membrane with three or more of the following: marked villous hypertrophy; proliferation of superficial synovial cells often with palisading; marked infiltration of chronic inflammatory cells (lymphocytes or plasma cells predominating) with tendency to form "lymphoid nodules"; deposition of compact fibrin, either on surface or interstitially; foci of cell necrosis.
11. Characteristic histologic changes in nodules showing granulomatous foci with central zones of cell necrosis, surrounded by proliferated fixed cells, peripheral fibrosis and chronic inflammatory cell infiltration, predominantly perivascular.

Definite Rheumatoid Arthritis. This diagnosis requires fulfillment of five of the above criteria. In criteria 1 through 5, the joint signs or symptoms must be continuous for at least six weeks.

Source: Williams, 1974, pp. 11-12

TABLE 1-1 CONT'D.

Probable Rheumatoid Arthritis. This diagnosis requires fulfillment of three of the above criteria. In at least one of criteria 1 through 5, the joint signs or symptoms must be continuous for at least six weeks.

Possible Rheumatoid Arthritis. This diagnosis requires fulfillment of two of the following criteria, and total duration of joint symptoms must be at least three weeks.

1. Morning stiffness.
2. Tenderness or pain on motion (observed by a physician) with history of recurrence or persistence for three weeks.
3. History of observation of joint swelling.
4. Subcutaneous nodules (observed by a physician).
5. Elevated sedimentation rate or C-reactive protein.
6. Iritis.

Source: Williams, 1974, pp. 11-12

II. Societal Characteristics of Persons with Rheumatoid Arthritis

The literature provides information about prevalence incidence, mortality, and costs associated with rheumatoid arthritis.

The CIOMS (Rome modifications of the ARA criteria is designed for epidemiologic studies. It has eliminated those aspects of the ARA criteria such as joint biopsies which are not feasible in field studies. Out of the following a patient must score 5 of 8 possible points; each worth 1 point, to be diagnosed for definite rheumatoid arthritis.

> Morning stiffness, pain or tenderness, soft tissue swelling 1 joint, soft tissue swelling of an additional joint, symmetrical swelling, nodules, x-ray changes, positive rheumatoid factor test. (Beasley, Retailliau & Healey, 1973, P. 738)

A third diagnostic system often used is that proposed by the Third International Symposium of Population Studies of the Rheumatic Disease in New York in 1966 (New York Criteria). In 1964 a study was undertaken to show what difference if any is obtained by choosing to use one criteria instead of another. In 1964, 4,552 people (77% of the population) of Sudbury, Massachusettes, aged 15-74 years were medically examined and tested for rheumatoid arthritis. Applying the ARA criteria 3.8% females and 1.3% males were diagnosed as suffering from probable or definite rheumatoid arthritis. These rates are in general agreement with existing population data. The New York criteria found that .5% females and 0.1% males met the new standard (O'Sullivan & Cathcart, 1972).

The following conditions comprise the New York criteria:

1. History of episodes of 3 painful limb joints (each joint group, e.g., proximal interphalangeal joints, counts as 1 joint)
2. Swelling, limitation of motion, subluxation of ankylosis of 3 limb joints (must include a hand, wrist or foot and symmetry of 1 joint pair and must exclude distal interphalangeal joints, fifth proximal interphalangeal joints, first metatarso phalangeal joints and hips)
3. X-ray changes (erosions)
4. Serum positive for rheumatoid factors

(Zvaifler & Robinson, 1974, p. 6)

Prevalence and Incidence

At least 50,000,000 Americans suffer from some form of arthritis with severity of the disease requiring 20,000,000 to seek medical care. Of these victims, 5,000,000 are said to have rheumatoid arthritis (Arthritis Foundation, undated). Dr. Earl J. Brewer, Jr., chief, Rheumatology Service, Texas Children's Hospital estimates that arthritis attacks a million people in Texas (Texas State Department of Health, 1975). Other prevalence data shows 12 million people in the United States to have rheumatoid arthritis (Marmor, 1963).

Rheumatoid arthritis is the most serious, painful and crippling of the kinds of arthritis. The fact sheet compiled from information by the National Health Education Committee lists the following major forms of arthritis:

Rheumatoid arthritis	5 million
Osteoarthritis	10 million
Gout	1 million

LeRoy (1944, p. 99) suggests that between 1-3% of the world's population has rheumatoid arthritis. This agrees with a 2% estimation of rheumatoid arthritis in the adult population by Ansell and Bywaters (1963).

In projecting future trends, Somers (1971) sees the preponderance of female to male arthritics increasing due to the difference between male and female longevity. Life expectancy for males increased 13.4 years, for females 19.6 years between 1920 and 1967. In 1920, there were 104 males for every 100 females in the United States which decreased by 1967 to 96 males per 100 females. Considering the over 65 age group, the female prepondernace is more apparent as there are 100 females to

76 males.

Boyle (1971) estimates that there are approximately 175,000 cases of juvenile rheumatoid arthritis in the United States--4 per 10,000 of the total population. Prevalence of juvenile rheumatoid arthritis is difficult to estimate as few extensive population studies of the disease have been conducted.

Incidence

Most references to incidence figures are in fact prevalence figures. Under Incidence, Ansell and Bywaters (1963) use Lawrence's estimation that 2.7/1000 of the adult population have had a polyarthritis during childhood making a total of about 100,000 altogether in the United Kingdom. A possible explanation of the lack of incidence figures of rheumatoid arthritis may be the difficulty the disease presents in identifying new cases of rheumatoid arthritis. Bayles, Dawkins, Cullity, Davis and Houleston (1975) point out that many cases of inflammatory joint disease must be classified initially as undifferentiated polysynovitis while specific diagnosis is not possible till months later. Diagnosis of rheumatoid arthritis on the basis of nonspecific early manifestations often requires the later reclassification of some cases. Rodnan (1973) reports that discrepancies range between 0.5 and 3 new cases of rheumatoid arthritis/1000/year in surveys of the same population. A majority of subjects observed a few years later for the second time show little evidence of rheumatoid arthritis. This may be due to an initial incorrect diagnosis or to remission of the disease during subsequent surveys.

The Arthritis Foundation estimates that artiritis claims 600,000 new victims each year. To gain a better idea of rheumatoid arthritis incidence from this data, the Foundation lists 20,230,000 arthritics in the United States of which 5,000,000 have rheumatoid arthritis (The Arthritis Foundation, n.d.). Rheumatoid arthritis contributes roughly 1/4 of the total arthritic cases.

Rodnan (1973) approximates 500 cases of rheumatoid arthritis per year per 1,000,000 of the population.

Mortality

In spite of the fact that a patient may be completely crippled by rheumatoid disease, death directly attributable to the disease is uncommon (Barnes, 1972). Death may result from the effect of arteritis (inflammation of an artery), amyloidosis (the accumulation of amyloi[illegible] various body tissues, better called "protein proteinosis"), atlanto-axial subluxation [atlantoaxial--pertaining to the atlas and axis; atlas-first cervical vertebra, which articulates above with the occipital bone (back part of the head) and below with the axis; axis-second cervical (pertaining to the neck) vertebra; subluxation (an incomplete or partial dislocation)], and tho loucopenia of Felty's syndrome.

A patient may also succumb to the complications of treatment. Analgesics (an agent that alleviates pain without causing loss of consciousness) may cause gastrointestinal bleeding (salicylates, phenylbutazone, indomethacin). Phenacetin may damage kidney function and phenylbutazone may cause blood dyscrasias. Gold salts are known to cause bone marrow suppression, nephropathy (disease of the kidneys) and exfoliative dermatitis (dermatitus exfoliativa--a skin disease characterized by very extensive scaling, itching, abnormal redness and loss of hair). Corticosteroid therapy involves an appreciable mortality risk from peptic ulceration, infection and inability to respond to stress.

The Arthritis and Rheumatism Council Field Unit for Epidemiological Investigations reports that approximately two-thirds of the deaths from rheumatic complaints took place in a hospital, while only about half of all deaths occurred in the institution (The Arthritis and Rheumatism Council Field Unit for Epidemiological Investigations, 1971). Mortality from arthritis and rheumatism accounted for one-fourth of 1% of all deaths in England and Wales. Such deaths were a smaller proportion of the total deaths occurring at home or in other places, or in psychiatric hospitals but constituted a slightly larger proportion of those occurring in hospitals.

In considering mortality from rheumatic disease, it is important to establish perspectives. Not only is the problem small in terms of the number of deaths but mainly the elderly are affected. Peak mortality from rheumatoid arthritis in females occurred in the decade of 70-79 years with three-fifths of these deaths affecting females over the age of 70. Data on male arthritics is similar with peak mortality showing five years younger than that observed in the females.

An appreciable proportion of deaths assigned to rheumatoid arthritis are so labeled because the stated primary cause of death is unacceptable for coding for registration purposes. However, such terms as senility are revealing and can modify one's interpretation of the extent to which a disease like rheumatoid arthritis has contributed to the fatal outcome.

Moesmann (1969) reports that in insidious and subacute rheumatoid arthritis with onset in old age, cancer is the cause of death in

5 of 14 patients (36%) observed. Among 77 patients with connective tissue syndromes associated with carcinoma, 8 with rheumatoid arthritis in old age were found. In the non-geriatric rheumatoid arthritis series, 4% of those affected had carcinoma with malignant diseases causing 7-13% of rheumatoid arthritis deaths.

Anttila and Laaksonien (1969) estimate that 20% of the causes of mortality in patients with rheumatoid arthritis are from kidney complications. The authors compare this percentage with similar estimates by Kuhns and Joplin (1963) at 15%; Snorrason (1950) at 11%; Gedda (1955) at 24%; Teilum and Lindahl (1954) at 27%; and Clausen and Pedersen (1961) at 34%. Uremia was the cause of death in 12 children (52%) in the reported series by Anttila and Laaksonien. Previous estimates were made by Edstrom and Gedda (1957) at 33%; Ansell and Bywaters (1956) at 22.2% with 1963 data showing 15.8% and Laaksonien (1966) at 57% for uremia causing death in juvenile rheumatoid arthritis patients.

Of 316 cases of juvenile rheumatoid arthritis reported by Ansell and Bywaters (1963), 19 children died. Death resulted from uremia secondary to amyloidosis in 3 patients, uremia secondary to infection in 5 patients treated with steroids and with complications of specific childhood infections such as measles in 2 children. Two patients with juvenile rheumatoid arthritis were considered to have died from the effect of the disease while other causes of death varied from serum hepatitis to a post-operative complication of an operation for congential aortic stenosis (a narrowing of the arotic orifice of the heart or of the aorta itself).

Cost

Rheumatic complaints form one of the major health burdens borne by the United States population. The economic burden is further enhanced by the chronic and generally non-fatal nature of rheumatic conditions. Whereas major killers such as cancer, stroke, and heart disease, remove people from being consumers a relatively short time after they have stopped being producers, crippling conditions such as arthritis usually leave people suffering as consumers for long periods of time after they have been incapacitated for production (The Arthritis and Rheumatism Council Field Unit for Epidemiological Investigations, 1971).

In 1971, the National Health Education Committee estimated the cost of rheumatic disease and arthritis at $3,645,000,000. $1.7 billion is lost in wages and salaries by persons unable to work becuase of rheumatic conditions and $1 billion is spent on annual medical care costs (National Health Education Committee, 1971).

As of September 1968, 301,064 veterans were receiving compensation or pension payments whose major disability was classified as arthritis or rheumatic disease. The estimated annual value of payments was $271,130,256 (Licht, 1969; National Health Education Committee, 1971). In the same year, the welfare administration of the United States paid almost $50 million to disabled arthritics. The Social Security agency alone paid more than $80 million to arthritics under the Disability Insurance Program (Licht, 1969). The Federal government loses each year over $200 million in income and excise taxes on the wages and salaries lost by persons unable to work because of arthritis and rheumatism (National Health Education Committee, 1971). In contrast, the United States government spends less than $.75 per victim annually on arthritis research and training, to which the Arthritis Foundation and its chapters are able to contribute less than $.12 (The Arthritis Foundation, n.d.). Licht (1969) estimated that in 1968 Americans spent more than $300 million for "treatments" without benefit to anyone but vendors.

A cost-benefit analysis of patients treated at a Glasgow Rheumatism Center between 1965 and 1966 concluded that net benefits exceeded costs under all the assumptions of the study, leading the researchers to encourage the investment of public funds in the treatment of rheumatic diseases. An earlier HEW study led to similar conclusions. In response to the HEW recommendations, Congress appropriated funds to establish an initial regional arthritis control study, but continued financial support was withdrawn just as the study was getting underway (Mikkelsen, 1973).

III. Demographics

Sex. There is general consensus that rheumatoid arthritis affects women more frequently than males. Sex ratios of females to males range from three to one to three to two in most large studies (The Arthritis Foundation, 1966; Rodnan, 1971-72). A Jamaican survey found the female to male ratio to be two to one (Lawrence, et al., 1966).

There is no clear explanation for the female preponderance, Some patients appear to develop the disability around the time of menopause. There is also the well-known clinical phenomenon of onset of arthritis or its severe exacerbation immediately after pregnancy (Williams, 1974).

The incidence of female arthritics appears to increase between the ages of 35 and 55, but examples of the onset of the condition are often recorded in both male and femlae elderly patients after the age of 60 (Williams, 1974). A prevalence study by Barnes (1972) found that 2.1% of the males in the sample were arthritics compared to 5.2% of the females. The prevalence of arthritis increases with age in both sexes, reaching a recorded maximum of around 6% in males over the age of 75 and 16% in females over 65 (Barnes, 1972).

Age. Though rheumatoid arthritis can occur at any age, it is most likely to strike people between the ages of 20 and 50, with a mean age at onset of around 40 years (Carter, et.al., 1974; The Arthritis Foundation, 1966; Adams, 1972).

Only a small percentage of rheumatoid arthritics are children, in whom the disease is usually milder than in adults. Occasionally, the condition has been noted in the first year of life, but is rarely seen before the age of six months.(The Arthritis Foundation, 1966).

Socio-Economic Status

Partridge & Duthie (1968) surveyed individuals in different occupational classes in order to assess the prevalence and social and economic effects of rheumatoid arthritis and other rheumatoid complaints. The sample consisted of 206 civilian dock workers (heavy manual laborers) and 138 civilian servants (sedentary workers). The prevalence of polyarthritis was found to be 5.1% in the civil servants and 3.9% among the dock workers, but the prevalence of conditions associated with neck and shoulder girdle pain was higher among the civil servants. A high rate of injury among the dock workers was considered to be an important factor in the prevalence of osteoarthrosis in this group. The implication of the study is that while rheumatic complaints may occur with equal frequency among both types of occupations, the manual laborers are more severely impaired once the condition is contracted.

Urban-Rural. Other sources have found that persons who work outdoors and who work with their hands appear to suffer more from rheumatic diseases than those in sedentary occupations. More farmers are stricken with arthritis and rheumatism than individuals in any other field or occupation. Factory workers make up the second largest group in this country affected by arthritis and rheumatism (National Health Education Committee, 1971).

IV. Etiology

Despite many years of intensive investigative effort, the etiology of rheumatoid arthritis remains obscure. Endocrine, metabolic and nutritional factors, as well as geographic, occupational and psychosocial variables have all been the subjects of studies. Although perhaps influencing the course of the disease to some extent, none of these variables, either alone or in combination has been clearly implicated in the causation of the disease. Familial and genetic studies have provided inconclusive and often conflicting results. The existing data do not support the concept that rheumatoid arthritis is a hereditary disease in the conventional sense. It appears more likely that genetic factors influence the expression of the disease, perhaps by their effect on the immunologic phenomena that play an important role in its pathogenesis (Dorland's Illustrated Medical Dictionary, 1957). Barnes (1972) suggests that the etiology or initiating factor may have to be considered separately from the pathogenesis, or perpetuating factor. It is conceivable that a wide variety of different initiating factors, either infective or traumatic in the widest sense, may initiate a situation which may precipitate an immune reaction within the joint. This reaction may then become perverted and self-perpetuating, perhaps even after the initiating factor has ceased to operate.

Of the many and varied hypotheses of the primary cause of rheumatoid arthritis, autoimmunity has been given serious consideration by a number of researchers. Autoimmunity refers to derangement of the body's defense or immune mechanism and is one of the two leading theories of the etiology of rheumatoid arthritis. Basically, the theory supposes the existence of a disorder in body chemistry in that the body produces antibodies which attack its own joints and tissues. The suspected process by which the disorder occurs is a chemical chain reaction process and is known as autoallergy (JAMA, 1970).

The autoimmunity theory is based primarily on the discovery that a high proportion of patients with rheumatoid arthritis have an identifiable antibody circulating in their blood. This entitity, known as the Rheumatoid Factor (RF), reacts specifically with gamma globulin (a body protein). The source of the antigen and other details of the mechanism by which the RF is formed are still unknown. It is possible that the RF is formed in response to some alteration or denaturation of the gamma globulin molecule. As a result of this process, an antigen, previously buried within the molecule and consequently, unfamiliar to the body, may become exposed. If this alteration of the gamma globulin molecule and subsequent release of the antigen were to take place in cells of the synovial membrane or elsewhere in a joint, the ensuing reaction between antigen and antibody could set up an inflammatory reaction (arthritis) at the same site (Adams, 1972).

The usual clinical tests used for detecting the presence of the RF are agglutination procedures which utilize sheep RBD's sensitized with rabbit, anti-sheep cell antibodies or inert particles (latex or bentonite). Using the agglutination or bentonite flocculation test, the RF has been detected in approximately 70% of adult patients with rheumatoid arthritis. A positive test, however, does not necessarily imply a diagnosis of rheumatoid arthritis; the RF has been detected in between one and five percent of normal subjects tested. Also, the incidence of the RF increases with age and variety of other disease states. Though its absence does not exclude the existence of rheumatoid arthritis, detection of the RF is frequently useful in differentiating rheumatoid arthritis from other arthritides and has considerable prognostic significance. When the amountof RF in the blood is quantified by serial dilutions, rheumatoid patients usually have a much higher concentration of RF than do normals or those with other diseases (Zvaifler & Robinson, 1974).

Thus, there is no conclusive evidence that the RF alone is responsible for the changes that occur in affected joints. It is not present in every patient with rheumatoid arthritis and conversely, it may be present in persons who have never had signs or arthritis. Transfusions into volunteers of the blood plasma of patients with rheumatoid arthritis has not caused arthritis, or any ill effect in the recipients. It is certain that other influences are involved in the etiology of rheumatoid arthritis (Adams, 1972).

Another leading theory of the etiology of rheumatoid arthritis is the infection or viral theory. The occurrence of polyarthritis during the course of many bacterial and viral diseases of man and the resemblance of rheumatoid arthritis to certain veterinary diseases known to be caused by micro-organisms, provides the infection hypothesis considerable credibility. Reports documenting the recovery of various micro-organisms from the blood, bone marrow, lymph nodes, synovium and synovial fluids of patients with rheumatoid arthritis have appeared sporadically since the beginning of the century, but no one agent has been recovered consistently. Most recently, the possibility of a viral etiology, perhaps of the latent type, has become popular, but no direct evidence of viral infection has been discovered (Zvaifler & Robinson, 1974). Some authors suggest that infection triggers a chain of events leading to arthritis even though the germ or virus itself may be gone by the time the disease develops (The Arthritis Foundation, 1966).

Circumstantial evidence tends to support the concept of infection as the major cause of rheumatoid arthritis. The RF has been found in the blood of patients with many types of infection, including bacterial infection of the heart, leprosy, syphilis, malaria, and other viral infections. Certain clinical features appearing at the onset of rheumatoid arthritis are suggestive of infection, particularly the fever, rashes, enlargement of the lymph and enlargement of the spleen. Patients often report the occurrence of upper respiratory tract infections preceding the onset of arthritis. Further suggestive evidence has been provided by a study of arthritis among swine which is caused by an erysipolothrix infection. The disease presents pathological and clinical features that closely resemble those of rheumatoid arthritis in man. Also, animals infected with this disease have a high concentration of the RF in their blood (Adams, 1972).

Other studies have found organisms known as mycoplasms in the joints of arthritics and other patients manifesting the related disorders, erythematosus and Reiter's disease. Subsequent studies, however, have so far failed to confirm these observations. Present knowledge concerning mycoplasms is inadequate and further work on the organism is in progress. Other organisms have been recovered from rheumatoid joints, notably, dephtheroed organisms. The significance of the presence of these organisms is not clear; similar organisms have been found in osteoarthritis (Adams, 1972).

The tendency for rheumatoid arthritis to be familial has long been recognized, but despite the evidence provided by familial, genetic and twins studies, the disease is not directly inherited. Sometimes it is seen in several members of one family, but it does not consistently run in families. (The Arthritis Foundation, 1966). Recent studies indicate that this familial concentration is seen only in the seropositive forms, especially those with grade 3 or 4 radiological changes and in those seronegative forms associated with psoriasis (chronic, recurrent papulosquamous dermatosis, the distinctive lesion being in the silvery gray scaling papulae or plaque) (Carter & Fairbanks, 1974).

Rather than being directly inherited, it seems more likely that an inherited predisposition to the disease is involved in its etiology. The degree of aggregation within families apparently depends greatly on the parameters used both to select subjects (probands) and to assess the prevalence in relatives. Assessment of the relative impact of environmental differences

is quite difficult in familial studies. In order to reduce environmental differences, a 1972 study compared relatives of probands with rheumatoid arthritics and their spouses. When the prevalence of the disease in the relatives was compared to that that of their spouses, the relatives were found to have had a greater incidence of rheumatoid arthritis which was highly significant. Differences between the two groups could have been the result of either genetic or environmental factors acting in the earlier years of life, or both. Probands who contracted rheumatoid arthritis early in life had the highest prevalence of the disease in their first generation relatives. The finding of an increased incidence among the older spouses suggested that environmental factors must have had some influence (Wasmuth, et al., 1972). Another study (Hellgren, 1969a) found no differences in the prevalence of rheumatoid arthritis
between spouses of arthritics and spouses of a group of matched, healthy controls of the same number.

Twin studies have been used to help in separating the influence of environment from that of heredity. Higher concordance rates in monozygous twins than in dizygous twins have been reported by a number of workers. Such rates suggest a genetic influence in the etiology of the disease. A mean concordance rate of 32% has been reported for monozygous twins compared to only 9% for dizygous twins. Before accepting these figures has proof of a genetic influence, however, other explanations for the high concordance rate must be considered. A difference in age or sex distribution between the monozygous and the dizygous groups, for example, might account for the greater concordance in the monozygous group. The proportion of seropositive and seronegative arthritis in the index twins could also play a part (Lawrence, 1970).

Data from the Manchester Family Survey (United Kingdom) show that clinical evidence was present in excess in the seropositive families. No significant aggregation was shown in the families of seronegative probands. When arthritis among relatives was divided into grades, it was found that the excess in the seropositive families was limited to the more severe forms which were nearly four times as common as in the population samples. In the seronegative families, both the minimal and severe forms of arthritis occurred with about the expected frequency. These findings indicate that heredity plays little part in the etiology of seronegative polyarthritis, but that in the more severe seropositive disease, the genetic predisposition appears to be important. The Manchester Survey also led to the following generalization: where the environment within the family is responsible for familial aggregation, different generations develop the disease at the same time and thus have the same prevalence; when heredity is responsible, different generations develop the disease at the same age. A higher prevalence in siblings indicates either an influence of the shared childhood environment or a recessive inheritance. A higher prevalence in parents and offspring, as was found in the Manchester Survey, favors a dominant or polygenic inheritance (Lawrence, 1970).

In a study of 7,405 relatives (down to and including third generation kin) of 399 probands (199 with rheumatoid arthritis), the frequency of rheumatoid arthritis among relatives was found to be 2.8 times as high as that in the control group. None of the probands with arthritis had both parents suffering from the disease, eliminating the occurrence of homozygotes. This investigation suggests that rheumatoid arthritis probably involves a non-sexed linked dominant hereditary mechanism with differences in prevalence between males and females (Lawrence, 1970).

Other studies have failed to show that genetic influences play a significant role in the etiology of rheumatoid arthritis. For example, a Swedish study

(1962-63) of 22,707 persons over the age of seven found no significantly higher frequencies of rheumatoid arthritis among relatives of arthritics than among matched relatives of matched controls (Hellgren, 1970c).

Some studies have produced evidence suggesting that rheumatoid arthritis may be the first clinical and symptomatic manifestation of cancer. The results of a 1961 study of 144 individuals (53 arthritics, 91 controls) imply that perhaps rheumatoid arthritis should be considered as a syndrome rather than a single well-defined disease. The data also support the view that rheumatoid arthritis is a condition which can occur as an allergic reaction to various noxious products, as in various diseases of the muscles and skin, and that the presence of arthritis should lead to further considerations, rather than a diagnosis in itself. Information from the study also support the hypothesis that rheumatoid arthritis may be the first clinical sign of cancer. From observations of the group of arthritic patients, 13 different kinds of cancer in a total of 26 patients was found in their initial stages. At no time had any of the patients shown any clinical signs or symptoms of malignant tumors. On the contrary, all showed the clinical signs and symptoms of a first degree progressive rheumatoid arthritis for which they had been initially hospitalized (Strandberg & Jarlow, 1961).

Further evidence was produced by the observation of four patients with rheumatoid arthritis, stages II and III, whose disease was under control in response to simple treatment. These patients later developed carcinomas of the pancreas, breast, cervix and ovaries. Four to six months prior to the discovery of neoplasm in each case, the arthritis suddenly became progressive and uncontrollable despite intensified therapeutic measures including the addition of corticosteroids. All the cases progressed to stage IV within a 12 month period (MacKenzie and Scherbel, 1963).

The importance of emotional upsets and other psychosocial factors in the etiology of rheumatoid arthritis is unclear, but the relation of severe disease exacerbations to abrupt emotional upheavals is clearly apparent in some patients. Many patients notice the beginning of symptoms following a disturbing event such as a death in the family, divorce, separation, or an emotional strain or shock. Worrying unrealistically about having arthritis may delay improvement in the patient who already has contracted the disease (The Arthritis Foundation, 1966). Observations such as the above do not imply that emotional or psychological factors cause rheumatoid arthritis, but only that they may contribute to the problem in some way.

The examination of the interaction of rheumatoid arthritis with the psychiatric profiles and life stresses in arthritic patients leads to several specific questions: 1) is there a typical personality or characteristic emotional problem in most patients with diseases? 2) if there is a distinctive "rheumatoid personality" or profile, is it relatively specific to rheumatoid arthritis? 3) are the psychiatric profiles and personality characteristics supposedly linked to the disease as predisposing factors, or are they the result of mutually predisposing factors shared by persons contracting the disease, or are they the result of mutually shared hardships and deprivations induced by the natural course of the condition? (Williams, 1974, pp. 218-19).

In-depth psychiatric analyses of personality patterns of arthritic patients have failed to produce any specific or diagnostic pattern. In this regard, particularly with respect to the possible interactions of the autonomic nervous system and the immune system, some new data appear to indicate important connections. Changes in the neuroeffectors of the sympathetic nervous system appear to influence both the first degree and second degree immune responses. It is therefore entirely conceivable that psychiatric stress, might influence some of the immunologic reactions possibly involved in the basic disease process. The focus of basic research in this area appears to be currently on the work involving chemical mediators of some types of immune reactions such as histamine release by basophils and mast cells as well as the influence of the cyclic-AMP and prostaglandin systems (Williams, 1974, p. 218).

The early work which attempted to study the psychological factors in the disease was based most on projective tests such as Rorschach or the TAT, or on interviews. Up to 1955, patients with rheumatoid arthritis were thought to be shy, depressed with subconscious hostility, unable to express outward anger or aggression and showing considerable difficulty in forming close relationships with others, along with conflict in sexual identity and adjustment. Most investigators believe that the various aspects of this personality structure are reactions to certain life events and stresses which are related to rheumatoid arthritis. There is little doubt that emotional disturbances in individual patients may have a profound effect by initiating relapses or prolonging periods of severe disease activity. However, there is still much doubt that a typical rheumatoid profile or personality can be defined (Williams, 1974).

More recently, objective and gradable testing procedures such as the MMPI or the Cattell's 16 Personality Factors Questionnaire have been used to measure personality profiles in patients with rheumatoid arthritis. These studies show mostly a consistent elevation in three categories: hypochondriasis, depression, and hysteria which comprise the classic neurotic triad or pattern of results in MMPI testing. This neurotic profile was also recorded for patients with multiple sclerosis or spinal cord injuries, indicating that it could not be considered a specific pattern linked only with rheumatoid arthritis (Williams, 1974).

The results of a study of 28 patients with peripheral rheumatoid arthritis indicated that arthritics suppress and or repress their feelings toward changing jobs and are unwilling to express their feelings toward changing residence. These findings are interpreted as indicating that arthritic patients are either unwilling or unable to express openly feelings of disatisfaction against stressful aspects of their environment and that they are unable to admit to themselves and to others their negative feelings toward their lot in life (Mueller et al., 1961).

Various other factors have been associated with arthritis, though their etiological significance is unclear. There is thought to exist a seasonal difference in onset of the disease among adult patients. More new cases have been recorded between October and April (Brooks, 1969). Exacerbations appear to occur more frequently during the colder months of the year, but changes in weather or climate don't seem to have a consistent effect upon the course of rheumatoid arthritis. Some patients experience changes in the intensity of their arthritis coinciding with variations in the weather. No consistent pattern, however, has been observed for all patients. (The Arthritis & Rheumatism Foundation, 1956; Williams, 1974).

Diet appears to play no part in the patient with rheumatoid arthritis outside of the fact that any chronic disease patient should follow a well-balanced diet. No specific foods should be eaten or avoided, but overweight patients should be reduced and the underweight should be made to maintain their nutrition (Lockie & Robins, 1958).

The etiology of Still's Disease is also unknown. No biochemical abnormalities have been identified nor has any infective agent been isolated. There is some evidence that hereditary factors may be operative. In relatives of patients with Still's Disease, there is a significantly increased incidence of arthropathy, either alkylosing spondylitis in male relatives or a peripheral erosue arthropathy in female relatives. Just as is the case with adult rheumatoid arthritis, it has been suggested that an altered state of immunity exists although whether this could be the basic abnormality in Still's Disease remains unknown (Barner, 1972).

TABLE 1-2
LIFE FUNCTION TABLE - ARTHRITIS: HEALTH

Statement of Problem	Dynamics	Source
Nodules in lungs or pleura (the serous membrane investing the lungs and lining the thoracic (chest) cavity, completely enclosing a potential space known as the pleural cavity).	Lung involvement - RA	E.C. Huskisson & F.D. Hart, 1975
Caplan's syndrome (multiple pulmonary nodules on chest X-ray).	Lung involvement - RA	-"-
Granulomatous in heart (composed of granulomas-tumor or neoplasm made up of granulation tissue) lesions in myocardium (middle and thickest layer of heart wall, composed of cardiac muscle).	Heart problems - RA rarely causes heart failure, valve lesions (particularly aortic incompetence) and mural thrombi with embolism.	-"-
Tenosynovitis - inflammation of a tendon sheath. Pain Local swelling Tenderness Trigger Finger Dysfunction and flexion Deformity	Around hands or wrists (65%)	-"-
Muscle wasting	Periarticular soft tissue problem (around a joint).	-"-
Subcutaneous nodule	Occurs in approximately 25% of patients; 10% Juvenile RA patients.	C.G. Barnes, 1972; R.C. Williams, Jr. 1974; R.G. Brooks, 1969.
Ulceration of the skin	Overlying the swelling of subcutaneous nodule.	
Pain	When the nodules overlie the ischial tuberosities (part of hip). Extensor surfaces of arms and elbows - probably the most commonly recognized sites.	
Skin become atrophic (thin and shiny)	Advanced stages of the disease. Usually most obvious on fingers and shins.	C.G. Barnes, 1972; E.C. Huskisson & F.D. Hart, 1975.

TABLE 1-2 cont'd.

Statement of Problem	Dynamics	Source
Ulceration of skin of lower leg also occurs spontaneously.	Associated with advanced stages of the disease.	C.G. Barnes, 1972; E.C. Huskisson & F.D. Hart, 1975
Redness of skin (palmar erythemia).		
Pericarditis - inflammation of the pericardium - fibroserous sac surrounding the heart.	Found in approximately 40% of patients coming to postmortem study. Rub audible at some time in about 10%.	C.G. Barnes, 1972; R.C. Williams, Jr. 1974; E.C. Huskisson & F.D. Hart, 1975.
Fever	Occurs in 3 out of 4 children with RA. Usually accompanies acute exacerbations of disease.	R.G. Brooks, 1969.
Peptic ulcer	Occurs in adults and children with RA with increasing frequency. Aggravated by severe medications used in therapy.	R.G. Brooks, 1969.
Dyspepsia - impairment of the power or function of digestion.	Personal examination of 406 patients with severe RA (both sexes).	F.B. Gibberd, 1965.
Non-toxic goiters (toxic goiters - characterized by abnormal protrusion of the eyeball).	Personal examination of 406 patients with severe RA (in females).	F.B. Gibberd, 1965.
Thyrotoxicosis - a condition resulting from overactivity of the thyroid gland.	Personal examination of 406 patients with severe RA	-"-
Pus producing (suppurative) arthritis.	Important complication of chronic rheumatoid arthritis. Usually occurs in older patients who have a long history of chronic debilitating arthritis.	D.L. Remoin & J.E. Wennberg, 1966.
Peripheral neuropathy	Developed by many patients. Usually develops insidiously but may be abrupt.	J.A. Boyle & W.W. Buchanan, 1971

Statement of Problem	Dynamics	Source
Nail changes - ridging	Appears to be related to age of patient rather than to duration of disease activity.	E.B.D. Hamilton, 1960
Joint inflammation - warm to touch, skin red in appearance.	General feature - seen to some extent in all patients	R.A. Watkins & D. Robinson, 1974
Swelling - may occur in and around one or more joints.	General feature	R.A. Wilkins & D. Robinson, 1974.
Leg ulcers	Minimal ulceration (1/8" or less in depth) Moderate ulceration (1/8"-1/4" in depth) Severe ulceration (1/4" in depth and over).	J. Beninson & D.C. Ensign, 1961.
Anemia	Degree of anemia usually parallels the severity of RA. Common.	L.M. Lockee & H.M. Robins, 1958; E.C. Huskisson & F.D. Hart, 1975
Epesclerites - inflammation of tissues overlying the sclera (the tough white supporting tissue of the eyeball).	Frequent type of eye involvement in RA. Recognized as a superficial type of inflammation which does not affect visual acuity and usually subsides spontaneously.	R.C. Williams, Jr. 1974.
Sclerites - lesion involving deeper portions of the coat of the eye.	Sometimes progresses to scleral thinning and even perforation.	R.C. Williams, Jr. 1974
Bursitis - inflammation of a bursa (a sac or saclike cavity filled with a viscid fluid and situated at places in the tissues at which function would otherwise develop).	Common, particularly olecranon (elbow) causes swelling and discomfort.	E.C. Huskisson & F.D. Hart, 1975

TABLE 1-2 cont'd.

Statement of Problem	Dynamics	Source
Rheumatoid rash	Juvenile RA. May appear at any time during course of disease. Particularly associated with fever, splenography and lymphadenopathy. Appearance can precede onset of arthritis by 6 months - 3 years.	R.G. Brooks, 1969.
Decrease in sexual libido.	Exhibited by 25% of 636 patients with definite RA.	B.J. terBals, 1960
Skin lesions around fingernails in 5%; gangrene of fingers or toes; rarely associated with vasculitis, inflammation of a vessel.	Exhibited by 5% of the RA patients studied.	E.C. Huskisson & F. D. Hart, 1975.
Iredocyclites - inflammation of the ires of the uliary body.	Children with RA often develop.	R.C. Williams, Jr., 1974.
Uveitis - inflammation of the uvea (the iris, uliary body and choroid considered together).	Often developed in children with RA. Most analyses of large series of patients fix the incidence in Juvenile RA at 5-20%. Unilateral or bilateral. Incidence in adult patients probably no higher than in general population - several surveys.	-"-
Susceptibility to infections.	Joints - commonest sites; Staphylococcus aureus most common organism; may be silent - not always accompanied by fever or leucocytoses.	E.C. Huskisson & F.D. Hart, 1975
Reduced menstrual span	Results of controlled study 209 females before and after development of RA. Apparent in females destined to develop RA.	A. Kay & F. Bach, 1965
Subfertility	-"-	-"-

TABLE 1-2 cont'd.

Statement of Problem	Dynamics	Source
Growth disturbances generalized and local.	Juvenile R.A. Alterations in body growth depend primarily on severity of disease and on the duration of disease activity.	J.A. Boyle & W.W. Buchanan, 1971; R.G. Brooks, 1969.
Disturbance of sexual maturation.	Juvenile RA.	J.A. Boyle & W.W. Buchanan, 1971
Osteoporoses - bone becomes less dense.	Frequently generalized commonly complicates RA. Aggravated by steroid therapy. Important cause of sudden worsening of pain in joints.	N.J. Zvoefler & C.A. Robinson, 1974; E.C. Huskisson & F.D. Hart, 1975.
Spinal cord compression	RA of upper cervical spine irreversible neurologic damage or occasionally death.	N.J. Zvoefler & C.A. Robinson, 1974.
Prodrome - - fatigue - diffuse pains - loss of appetite - loss of weight - vasomotor instability with hot and cold sensations - excessive sweating	Many patients with RA complain of ill-defined constitutional symptoms that may precede arthritis for weeks.	E.C. LeRoy, 1974
Deformity of the hands	ulnar deviation - produces very little functional disability	C.G. Barnes, 1972
Proteinura which is the result of amyloidosis - the accumulation of amyloid (abnormal complex material, most probably a glycoprotein, exact biochemical composition of which has not been defined)	May progress to renal failure	E.C. Huskisson & F. D. Hart, 1975.
Psoriasis - a chronic dermatosis, the distinctive lesion being a silvery grey scaling papule or plaque.	Study - 39,418 Swedes over 7 years; 661 with RA - psoriasis among 30 (4.53%) 661 controls - psoriasis among 18 (2.72%). Prevalence figures for clinical typical arthritis psorcatica 1.15% male psoriaties (a person affected with psoriasis).	L. Hellgren, 1969.

TABLE 1-2 cont'd.

Statement of Problem	Dynamics	Source
Synovial cysts (Baker's cyst).	Appear around any joint but particularly posterior to the knee. Raised pressure in knees with large effusions forces fluid into the cyst and may also cause joint rupture with calf pain, ankle oedema and positive Homan's sign resembling deep-vein thrombosis.	E.C. Huskisson & F.D. Hart, 1975
Lymphadenopathy - disease of the lymph nodes.	Generalized lymphadenopathy associated with severe exacerbations of systemic disease. Occurs in about 25% of all Juvenile RA patients and 30% of RA patients. May occur at any location - most often in the axillary (small hollow beneath the arm), cervical (neck), inguinal (groin) and epitrochlear regions.	R.G. Brooks, 1969; E.C. Huskisson & F.D. Hart, 1975
Splenomegaly - enlargement of the spleen.	Occurs in perhaps 1/4 of all Juvenile RA patients. Massive enlargement is unusual; rare in adults.	-"-
Ocular problems	Juvenile RA. May involve the iris, uliary body, lens, cornea and rarely sclera or choroid. Incidence varies from 2-15% in repeated series. Ocular inflammation usually begins several years after onset of Juvenile RA.	R .G. Brooks, 1969
Non-specific abdominal pain	Occurs in about 1/4 of children with RA during course of disease. No characteristic location. Varies from epigastric (upper middle region of the abdomen) to periumbilical (situated around the umbilicus) areas to areas designated by diffuse complaints. Pain may be mild and constant or acute and cramplike. Lasts an hour to several days. Usually limited to occasional attack.	-"-

TABLE 1-2 cont'd.

Statement of Problem	Dynamics	Source
Carpal tunnel syndrome Pain and burning or tingling paresthesias in the fingers and hand, sometimes extending to the elbow.	A complex of symptoms resulting from compression of the median nerve in the carpal tunnel.	E.C. Huskisson & F.D. Hart, 1975
Symmetrical sensorimotor Neuropathy	5% usually affecting legs.	-"-
Patchy sensory loss over tips of fingers and toes (Digital neuropathy)	Due to functional disturbances and/or pathological changes in the peripheral nervous system.	-"-
Autonomic neuropathy	Rare	-"-
Fractures, especially to the vertebrae	Occur spontaneously or with minimal trauma because of osteoporoses. Usually involves the thoracic or lumbar vertebrae	N.J. Zvaefler & C.A. Robinson, 1974.
Fatigue	Frequently a cause of considerable disability	-"-
Edema of the extremities	Sometimes a feature of the early stage of the disease. Localized chronic.	C.G. Barnes, 1972; E.C. Huskisson, & F.D. Hart, 1975.
Edema of the hands or forearm (10%) with active disease.	Ankle edema (rare).	

TABLE 1-3

LIFE FUNCTION TABLE - ARTHRITIS: MOBILITY

Statement of Problem	Dynamics	Source
Restriction or inability to do homemaking tasks.	Joint restrictions.	Watkins & Robinson, 1974
Inability to use scissors, toothbrush, comb, brush, toothpaste dispenser, set hair.	Upper extremitites joint restrictions.	-"-
Inability of inflamed joints to tolerate ordinary work loads.	Impaired nutrition of such joints.	-"-
Inability of weight-bearing joints to tolerate walking		-"-
Impairment or prevention of activities requiring dexterity, agility, specific technical functions.	Damage to upper extremities	-"-
Difficulty in getting into and out of bathtub.		Barnes, 1972
Inability to dress oneself, shave, wash or dry oneself.	Upper extremities and lower extremities restriction of movement.	-"-
Inability to reach into storage cabinet and grasp item.		Watkins & Robinson, 1974
Confinement to wheel chair	Involvement of hip joint rare in adults.	J.A. Boyle & W.W. Buchanan, 1971
Bed ridden existence		-"-
Foot drop Wrist drop	Symmetrical polyneurites of mixed motor and sensory type.	J.A. Boyle & W.W. Buchanan, 1971
Achilles tendon bursites - swelling of the heel.	Seen in approximately 3% of 250 RA patients.	J.A. Boyle, & W.W. Buchanan, 1971; N.J. Zvoefler & C.A. Robinson, 1971
Pain aggravated by walking due to shoe pressure.		-"-
Difficulty in bending due to stiffness.	May occur prior to, during, or following inflammation. Usually more noticeable in the morning.	R.A. Watkins & D. Robinson, 1974

STATEMENT OF PROBLEM	DYNAMICS	SOURCE
Difficulty with dressing the lower parts of the body.	Caused by tight back muscles. May be stretched by means of physical therapy to increase body flexibility.	Lowman, 1966
Inability to negotiate stairs.	Quadreceps femores (collective name applied to several leg muscles, inserting by a common tendron that surrounds the knee-cap and ends on the rounded protrusion of the inner and larger bone of the leg below the knee - acts to extend the leg upon the thigh. Strengthen this muscle - provide power to overcome these problems).	-"-
Difficulty mounting curbs.	-"-	-"-
Mechanical inability to use standard chairs and toilet seats.	Major problem of patient with hip or knee involvement.	-"-
Difficulty with doorways too narrow to permit passage of a wheelchair.		-"-
Difficulty getting into low beds.		-"-

TABLE 1-4

LIFE FUNCTION TABLE - ARTHRITIS: COMMUNICATION

Statement of Problem	Dynamics	Source
Inability to hold receiver end of phone during a conversation.		Watkins & Robinson, 1974
Inability to dial a conventional phone.		-"-
Inability to grasp conventional writing tools.		-"-

TABLE 1-5

LIFE FUNCTION TABLE - ARTHRITIS: SOCIAL-ATTITUDINAL

Statement of Problem	Dynamics	Source
Depression	Study - compared 50 RA patients with 32 patients with other chronic painful non-inflammatory skeletal diseases. Significant excess of mood disturbance and depressive reactions amongst RA patients (Beck Depression Inventory).	G. Zapherophoulos & H.C.Burry, 1974; H.J. Wyatt, 1969
Faulty sexual identification.	Especially prominent in female reheumatoid arthritics. Is a method of relieving hostility - may be due to hostile masculine identification. Means of acquiring competitive relationship with men (assuming position of head of household and making appropriate decisions) or as defense mechanism against sexual attack.	H.J. Wyatt, 1969 p. 80
Impotency	Male patients usually retain their masculine identity but are often partially impotent	H.J. Wyatt, 1969
Aggression - sometimes directed inwardly with resultant severe depression.	Often expression of inability to understand and cope with unanticipated problems of disability. Probably an emotional and verbal outlet for physical energy.	-"-
Bewilderment or uncertainty.	May occur early in course of disease when routines of daily living may be changed suddenly and drastically. Passage of time, empathy and encouragement usually results in gradual acceptance and readjustment.	-"-
Bitterness	May persist when the patient is deprived of physical form and function; fails to accept and benefit from any treatment (will not accept altered status). Often used as an escape from reality.	-"-
Cynicism	May be used as a means of adjustment by the more intelligent and educated patient.	-"-
Exaggerated acceptance of disability.	Can be harmful or beneficial. Sometimes a form of denial. False assessment of function and capabilities - excessive use of affected joints; excessive independence; rejection of therapeutic program.	-"-

Statement of Problem	Dynamics	Source
Suppression of anger and hostility.	Restricted or unexplained hostility is important feature of emotional status. Rarely lose temper.	H.J. Wyatt, 1969 p. 181-2
Overt hostility.	Overt expression of hostility - depression, divorce, relationship to social mobility. Arthritic symptoms may represent means of controlling hostile feelings.	Wyatt, 1969
Schizoid	Premorbid personality of rheumatoid arthritics more schizoid than in those with degenerative joint disease; Rorschach tests on males show many of pathological features present in psychotics.	-"-
Anxiety	May be expressed as an acute or chronic state with all its concomitant somatic symptoms. Can even progress to conversion or phobic symptoms.	-"-
Apathy	Person with premorbid personality lacking in drive and initiative may become completely apathetic when faced with personal problems of chronic joint disease.	-"-
Inadequacy, inferiority, humiliation.	Emotional reactions likely to be encountered in chronic, crippling joint disease where morbidity is impaired forcing dependence upon others.	-"-
Irony, resentment, querulousness.	Some patients may resent, consciously or unconsciously, new status after previous endeavors in life. Also continually ask "why did it have to happen to me?"	-"-
Masochism	Masochism - well recognized personality trait in rheumatoid arthritics; disease itself may give satisfaction.	-"-
Sadism	Dependency may be used to exert sadistic pressure on those who have previously neglected them.	-"-
Paranoia	Small percentage of patients become paranoid about their body - and self-image - develop delusions about being objects of pity and derision. May cause them to become homebound and eventually to withdraw from the world.	-"-

TABLE 1-5, cont'd.

Statement of Problem	Dynamics	Source
Frustration	Inevitable consequences of crippling disease in an intelligent, previously very active individual. (Dependence on others for intimate aspects of personal hygiene, failure of medical science to discover cause of disease and knowledge that symptomatic remedies only give temporary relief, inability to fully participate in family life).	H.J. Wyatt, 1969
Guilt	Particularly in diseases where etiology unknown, most individuals seek precipitating factors within themselves, their behavior or environment to explain why they are affected. Try to accept disease as just retribution.	-"-
Impatience or intolerance.	Most patients become impatient with failure of medicine to discover specific cure. Become intolerant of disease and of the staff treating them.	H.J. Wyatt, 1965
Dependence		H.J. Wyatt, 1969
Disillusionment	May come with failure to obtain one's ideals despite exemplary life while others less honest are in good health and are successful too.	-"-
Distress due to disturbance of Body and Self-image.	Distortion by disease or deformity may lead to emotional stress.	-"-
Envy	When chronic disease or disability prevent one from conforming to accepted social norms natural for envy to develop especially during exacerbation of joint disease.	-"-
Fear - of progressive crippling and resulting burdens on self and family.	Important to allay this early. Reassure patient that symptoms can be relieved by variety of measures and severe deformity and disability can be prevented.	-"-
Fear of going out and meeting people.	Phobic anxiety may interfere with rehabilitation.	-"-

VI. Functioning as a Member of Society

The literature provides information about participation in the labor force and the community by persons with rheumatoid arthritis.

Functioning as a Member of the Labor

Unemployment rates among arthritics are reportedly quite high, though studies have produced conflicting results. Duthie, *et al.*,(1964) reported on a sample of 307 patients admitted to a rheumatic unit in a general hospital between the years 1948 and 1951. Of these individuals, only 76 had been gainfully employed one year prior to admission and at admission only four of these were still engaged in normal employment. Fourteen were doing light work at admission. The remainder of the patients were not working at all. In a follow-up performed two years after discharge, twenty-nine of the individuals were working in normal employment capacity, and thirty-three were engaged in light work. A final assessment was made of 46 patients. Of this number 22 were normally employed and 15 were employed in light work positions.

It is obvious from the above figures that many arthritics, due to the nature of their impairments are not capable of performing all types of activities. Most who return to work must change the nature of their work, and in many cases, this change is toward a lower paying job (Anderson and Duthie, 1963). Limitations in types of work possible often rule out jobs requiring hand and arm activities, standing, walking, or climbing and lifting. For the housewife, these limitations restrict participation in heavy housework. The Duthie, *et al.*, (1964) sample included 171 housewives. At the time of initial assessment, none were judged as fit to perform all household duties. Nine percent were capable of performing all duties except the very heaviest; 51 percent were able to do light housework; and 40 percent were incapable of performing any type of work. Two years after discharge, 16 percent of the housewives were able to perform all household tasks, 46 percent could do all but the heaviest, and 27 percent oculd do light housework. Eleven percent were still incapacitated. A final assessment of 125 housewives found that 18 percent were fit for all household activities and 46 percent could perform all types of tasks except the heaviest. Among the working population in both the male and female groups at final assessment, just over 68 percent were still gainfully employed.

Ragan & Farrington (1962) report more encouraging information with regard to employment of the arthritic. A follow-up study of 500 patients who had presented themselves to a clinic in a voluntary hospital and were diagnosed as suffering from rheumatoid arthritis, yielded one striking feature: a high percentage of the former patients had managed to remain effective socially and economically for more than five years after discharge. It should be noted, however, that an appreciable number of these patients had a milder level of arthritis than is normally found in similar studies.

Manheimer & Benton (1960)studied the arthritis patient's ability to sustain employment. Out of a group of 99 former patients, 70 percent were still working. More than one-half had worked for over a year, several had worked for two years, and still others reported increased wages. Of thirty patients who were unemployed, only six indicated that their situation was attributable to their disability, six had left work for reasons not associated with arthritis, seven gave other or imprecise health reasons, and eleven gave no reason for their unemployment. Seventy percent of the 99 subjects had been diagnosed as having rheumatoid arthritis, and their ability to remain on the job was found to be equal to that of patients with other types of rheumatic diseases. Many patients had been placed in jobs which differed considerably from their former work experience, and almost all had made some change in their occupations.

Manheimer & Benton (1960) indicate that severe functional impairment does not in and of itself preclude a return to work, and thus should not necessarily be used as a selection criterion for inclusion in vocational rehabilitation programs. Rheumatoid patients normally constitute no more vocational risk than patients with other types of rheumatic diseases. While most arthritics needing vocational rehabilitation are likely to be at least 40 years old, middle age is not a serious impediment, and even the elderly have been placed in jobs. Out of a sample of 332 arthritics, one-third of those 60 years of age and over returned to work. Table 1-7 presents the Manheimer & Benton (1960) findings according to age, number referred to vocational rehabilitation, and the number and percents who successfully returned to work.

~~TABLE~~ 1-7

AGE OF RHEUMATIC PATIENTS RELATED TO THEIR ABILITY TO RETURN TO WORK

Age	No. Referred to VR	Returned to Work No.	Percent
Up to 19 years	16	5	31%
20-29 years	34	15	44
30-39 years	44	17	39
40-49 years	81	44	54
50-59 years	99	33	33
60 years and over	58	19	33
Total	332	133	40%

Source: Manheimer & Benton, 1960

Functioning as a Member of the Community

The progressive crippling associated with arthritis may have especially debilitating effects on social interaction. As the patient becomes more disabled, depression may result from decreased social life, the need to restrict physical and occupational activities, and from feelings of helplessness over the condition. Mobility impairments often require the arthritic to be dependent on others for the more intimate aspects of personal hygiene, such as bathing and dressing. Fear and guilt feelings have been noted in the arthritic, who as a result of the progressive crippling, finds him or herself placing more and more burdens on the family and friends (Wyatt, 1969). A good deal of mental stamina is necessary in order to be able to accept the reduced field of activities, and older patients in particular, may become isolated from their families and relatives (vanDam, 1960).

Frustration is an evitable consequence of a crippling disease in an intelligent, previously active individual, and is compounded by the lack of cure for arthritis. Many patients become impatient with remedies which only offer temporary relief from symptoms. Arthritics are notably the most exploited of all victims of diseases in the United States. More than $310,000 is spent annually by arthritics on worthless or harmful treatments, cures, and devices. Often this is due to misrepresentation on the part of advertisers. The Arthritis Foundation (b) says that aspirin, in proper doses, is good for arthritis, but advertising, which implies that arthritis is nothing more than a disease of "minor aches and pains," is harmful. Such statements often lead to self-diagnosis and can delay appropriate treatment.

Local chapters of the Arthritis Foundation's information and referral centers distribute literature and sponsor forums and lectures to keep patients and physicians aware of the latest developments in arthritis research and treatment. These chapters support a wide variety of community services, including clinics, aimed at improving available care, from diagnosis to back-to-work programs (The Arthritis Founation, a).

VII. Technologies

1. Immunosuppressive drugs (Licht, 1969)

2. Analgesic & anti-inflammatory drugs (Garren, 1959; Williams, 1974; Hakisson, 1975)
   - Salicylates
   - Chrysotherapy
   - Steroids
   - Phenylbutazone
   - Chloroquine
   - Hydroxychloroquine
   - Sedatives
   - Analgesics
   - Supportive treatment (e.g. iron vitamins)
   - Aspirin
   - Cortisone

3. Occupational Therapy (Barnes, 1972)

4. Rest (Barnes, 1972)

5. Intra-articular injections (Adams, 1972)

6. Surgery (Adams, 1972)
   - Synovectomy
   - Osteotomy
   - Arthroplasty
   - Arthrodesis

7. Supportive Appliances
   - Splints (Barnes, 1972; Moskowitz, 1975)
   - Special shoes (Garren, 1959)

8. Arthrocentesis (joint aspiration)

9. Needle biopsy of the synovial membrane

10. Physiotherapy
    - Surface heat
    - Short-wave diathermy
    - Ultra-sound therapy
    - Electrical stimulation of muscles
    - Active Exercise
    - Passive joint movements
    - Massage
    - Manipulation (Adams, 1972)
    - Radiotherapy

11. Psychotherapy

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CHAPTER 2
DISABILITY ANALYSIS: CORONARY HEART DISEASE

I. Definition

Coronary Heart Disease (CHD) consists of an obstruction or narrowing of coronary arteries, reducing the blood supply to the heart muscle. The underlying cause of the obstruction is coronary atherosclerosis, but an acute coronary artery occlusion is often caused by the formation of a blood clot in a diseased artery.

Clinical manifestations of CHD are angina pectoris, recurrent brief attacks of chest pain caused by inadequate blood supply to the heart muscle; myocardial infarction, or necrosis of a portion of the heart muscle due to acute loss of blood supply; congestive heart failure, a chronic state caused by inability of the heart to pump enough blood to satisfy the demands of the body; cardiac arrhythmias, variation from the normal rhythm of the heart beat; and sudden death resulting from cardiac standstill or ventricular fibrillation (Report from the Surgeon General, 1964).

These overt manifestations of arteriosclerotic coronary disease usually occur after the arterial disorder has been present for many years. Besides the aforementioned clinical phase of the disease, there is also an incubation period and a quiescent or asymptomatic interval.

Research by Osborn discovered only one-third at age five to have normal arteries found at birth. After age fifteen, it is very rare to find the human natal condition as lesions appear with increasing frequency (Brest, 1969). This presence of coronary arteriosclerosis in young male Americans was supported by McNamara, Molot, Strample and Cutting (1971) with their examination of Viet Nam War casualties.

After development of the arteriosclerotic lesion and during the advancement of the arteriosclerotic process which causes the vessel to narrow, there is the quiescent time. The clinical state appears any time after this depending on collateral circulation and the multiple factors affecting the metabolic requirements of the myocardium. In some patients during the asymptomatic stage, clinical signs such as nonspecific electrocardiographic abnormalities may be detected (Brest, 1966).

In the labeling of coronary artery disease, there is a great deal of terminology mixing and many terms are used synonymously when they were not so meant to be employed. Examples of this are found in the interchangeable use of the terms atherosclerotic heart disease, coronary heart disease, coronary atherosclerotic heart disease and ischemic heart disease.

Atherosclerotic heart disease (AHD or ASHD) may be employed to designate the various clinical cardiac manifestations due to coronary atherosclerosis and its anatomic cardiac sequelae (Friedberg, 1966).

Hurst (1970) alleges that the term coronary atherosclerotic heart disease suggests that a specific disease - coronary atherosclerosis - is present and that other diseases of the coronary circulation are not. This same author maintains that CHD implies that there is a disease of the coronary arteries (even though the term does not have the word "artery" in it) and that the disease is of sufficient severity to cause heart disease. In an effort to be all-encompassing, health statisticians as late as 1966 used the term degenerative heart disease (Hurst, 1970).

Some investigators, especially British and European doctors, prefer the term Ischemic Heart Disease (IHD) since the clinical manifestations can occur despite the absence of obstructive atherosclerotic lesions in the coronary arteries. Harrison and Reeves (1968) define IHD as a group of disorders characterized by the undoubted presence of angina pectoris or myocardial infarction (recent or remote) or both. A more detailed explanation of IHD is found in the definition of Selber and Katz (1975): IHD is an impairment of cardiac function resulting from an imbalance between myocardial energy expenditure and the ability of the coronary vessels to supply sufficient chemical energy for normal cardiac function. This allows for circumstances, such as severe anemia or marked hypertrophy, in which the physiologic demands on the heart exceed the ability of the normal coronary arteries to deliver the required amounts of substrates and oxygen to the myocardial cells as well as those circumstances in which pathologic changes in the coronary arteries prevent an adequate delivery of chemical energy. According to Selber and Katz (1975) it is evident that coronary artery disease can occur without producing overt manifestations of IHD, but ischemic heart disease can exist only when there is an abnormality of the coronary arteries that impairs the blood supply of the heart. The authors recognize that adults often have significant occlusive disease of the coronary arteries without symptoms and without objective signs of cardiac dysfunction. Selber and Katz (1975) propose that such individuals have anatomic coronary artery disease, but do not have IHD as they defined above.

II. Societal Characteristics of Persons with Coronary Heart Disease

The literature provides information, about prevalence, incidence, and costs associated with coronary heart disease.

Prevalence. The American Heart Association (1973) estimates approximately 4,040,000 persons with CHD were living in the United States in 1969. This figure is based on reports of the diseases in each heart association affiliate area.

The National Health Examination Survey (1965) estimated that of the 111.1 million adults in the United States aged 18-79, at least 14,600,000 persons had some type of heart disease. It was calculated from the survey results that at least one-fifth (21.4 percent) of these cases involved CHD. In actual figures, 3.1 million adults were diagnosed with definite CHD (versus 2.4 million suspect) while 1.5 million had angina pectoris (versus 2.3 million suspect) and 1.4 million had definite myocardial infarction.

CHD rarely manifests itself before age 45, but may appear from ages 25-79 years. The prevalence rate rises with age. The highest age-specific prevalence rate of 15.4 percent is 65-74 years. From ages 75-79 years, the rate drops to 12.4 percent of the group having some form of CHD reflecting the consistent rise in mortality rate with age and the decrease in incidence after age 64.

The prevalence rates found by the survey were conservative because of the procedures and criteria for diagnosis of CHD. Acutely ill persons could not come in for examination. For the diagnosis of myocardial infarction, a current ECG pattern was required. This excluded persons without angina pectoris whose ECG patterns were never indicative of myocardial infarction, or which were but were now normal. It also excluded those patients whose only evidence of experiencing a myocardial infarction are clinical findings as their ECG does not evidence the occurrence (National Health Survey, 1965; Stamler, 1967; Moriyama, Krueger & Stamler, 1971).

The Framingham Massachusetts Study found of its initial population, 48 men out of 2,024 and 28 females out of 2,445 examined in 1949-1952 had AHD. Examination of the data, divided into 4 year age groups, starting at age 30, shows low initial prevalence for both males and females which sharply increased in the two age groups of 50-54 and 55-59 especially in the male participants. The 60-62 age group returned the initial low prevalence. Prevalence figures in the Framingham Study were minimum estimates as only those well enough to attend the clinic were counted and their health was judged according to the agreed criteria of the study group for AHD (Dawber, Moore & Mann, 1957; Moriyama, Krueger & Stamler, 1971).

Incidence. Naughton (1966) estimates manifestation of CHD to be in excess of 2 million new events annually in the United States. This incidence rate appears to be based on 1971 American Heart Association figures. Other available incidence rates for CHD are from various prospective studies.

A rate of 47.8 cases per 1,000 of CHD was reported in the first eight years of the Framingham Massachusetts Study; 245 people developed CHD out of the entry population of 5,128 men and women aged 30 to 62 who were initially free of CHD (Moriyama, Krueger, & Stamler, 1971). A 12 year follow-up of the Framingham Group showed that in 10 years, 1 in every 10 men and 1 in every 20 women aged 30-62 developed CHD (Kannel, Castille, & McNamara, 1967). This incidence rate from the extended follow-up influenced Kannel, et al. (1967) to view more than one-fourth of the adult population as unusually susceptible to CHD. Thus, even those people not judged to be prone to CHD have a good chance of developing the disorder.

The Los Angeles study of heart disease in a working population of 2,252 persons of whom 1,859 were males and 393 were females aged 18-70 with a median age of 43.7 years was initiated in 1949. After observation for two to three years, the average incidence of CHD in males under 40 was 0.1 percent, 8 percent for the 40-54 age group and 2.9 percent for those 55-70 years (Chapman, Goerke, Dixon, Loveland, & Phillips, 1957).

A 31 month following of a group of 1,701 male New York State Civil Service Employees aged 39-55 in the Albany area in 1953-1954 had an annual incidence rate of 9 per 1,000. Forty new cases of IHD were diagnosed for the 1,701 males. This compares with the annual incidence of 7 per 1,000 incidence rate in the Framingham and Los Angeles studies (Doyle, Heslin, Hilleboe, Formel & Korns, 1957).

Mortality. In 1967, there were over 600,000 deaths due to coronary heart disease. Approximately 167,000 of the coronary deaths occurred in persons under age 65, with more men than women dying from the disorder by a factor of 3 to 1 (Table 2-1). Comparing mortality rates for white middle-age men, the United States has one of the highest CHD death rates in the world (Table 2-2).

A North American male has about a one in five chance of developing clinical CHD before age 60. It is usually manifested as myocardial infarction. Most patients who experience fatal heart attacks succumb so swiftly that they are not reached by medical personnel or hospitalized. The National Heart and Lung Association estimates that about 60 percent of 400,000 annual fatal heart attacks fall into this category. Another estimate is about 25 percent of those experiencing a first premature heart attack die within three hours of the onset of symptoms with an additional 10 percent dying within the first weeks of their attack. In general, if a patient doesn't die suddenly, he runs a high risk of death in the period closely following the attack (Moriyama, Krueger, & Stamler, 1971).

The study by Gertler, White, Simon and Gottsch (1964) showed that the long term prognosis for CHD is generally inversely related to the person's age at the first episode. Coronary patients up to 35 years had an equal or slightly better chance of surviving the first ten years after their recovery from their first myocardial infarction as did the older group of patients of 36 years or more. However, during the subsequent period, the older group had a better chance of survival although the 45-54 year olds were five times as likely to die in the next five years as someone without a history of coronary heart disease. The leading cause of death or disability in the initial survivors is further manifestation of CHD (Dimond, 1963; Gertler, White, Simon, & Gottsch, 1964).

TABLE 2-1

NUMBER OF DEATHS AND MORTALITY RATES FROM CORONARY HEART DISEASE,* BY AGE, SEX, COLOR

UNITED STATES--1967

	AGE										
Sex-color group	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+
Number of Deaths											
White male	24	12	27	136	889	9,359	34,865	71,323	99,092	92,377	35,961
White female	9	8	22	57	252	1,675	7,290	22,490	57,827	89,644	54,761
Non-white male	10	4	11	52	304	1,432	3,611	6,430	7,937	5,134	1,959
Non-white female	8	6	5	29	191	752	2,068	4,144	6,332	4,723	2,446
All males	34	16	38	188	1,193	10,791	38,476	77,753	107,029	97,511	37,920
All females	17	14	27	86	443	2,427	9,358	26,634	64,159	94,367	57,207
All whites	33	20	49	193	1,141	11,034	42,155	93,813	156,919	182,021	90,722
All non-whites	18	10	16	81	495	2,184	5,679	10,574	14,269	9,857	4,406
All	51	30	65	274	1,636	13,218	47,834	104,387	171,188	191,878	95,127
Death Rates per 100,000 Population											
White male	1.6	0.1	0.2	1.0	8.9	90.1	352.7	937.9	2,072.7	4,083.9	9,081.1
White female	0.6	0.1	0.2	0.4	2.5	15.5	69.7	268.9	964.6	2,772.8	8,284.5
Non-white male	3.3	0.3	0.4	2.5	23.8	117.3	343.2	840.5	1,917.1	2,579.9	3,919.0
Non-white female	2.7	0.5	0.2	1.4	13.1	52.3	174.1	495.7	1,297.6	1,881.6	3,706.0
All males	1.9	0.2	0.2	1.2	10.6	93.0	351.8	928.9	2,060.7	3,962.3	8,502.3
All females	1.0	0.2	0.2	0.5	3.8	19.8	80.3	289.5	989.5	2,708.6	7,868.9
All whites	1.2	0.1	0.2	0.7	5.6	52.1	207.2	587.5	1,456.2	3,312.5	8,583.0
All non-whites	3.0	0.4	0.2	2.0	18.2	82.1	253.6	660.1	1,581.9	2,190.5	3,797.4
All	1.4	0.2	0.2	0.8	7.1	55.5	211.8	594.0	1,465.9	3,227.6	8,102.8

*ICD Categories 420-422, Seventh Revision.

Source: Wright & Frederickson (1973) p. 16

TABLE 2-2

22 COUNTRIES RANKED BY MORTALITY RATES FOR CORONARY HEART DISEASE MALES, AGE 45-54

Country	1964 Mortality rates per 100,000 population Coronary heart disease	All cardiovascular diseases	All Causes
Finland	442	579	1,120
Scotland	359	463	933
U.S.A.*	354*	477*	964*
Australia	324	425	821
No. Ireland	324	465	804
Canada	311	385	752
New Zealand	293	386	758
U.K. - Eng. & Wales	254	341	734
Israel	214	302	572
German Fed. Rep.	182	275	772
Denmark	181	248	613
Norway	164	218	566
Netherlands	162	222	582
Austria	159	263	823
Belgium	159	302	820
Czechoslovakia	151	263	738
Switzerland	134	210	658
Italy	133	239	717
Venezuela	131	235	897
Sweden	124	189	522
France	74	202	863
Japan	51	251	733
Mean	212	315	762
Standard Deviation	= 103	= 109	= 145

*For white males only, mortality rates are: CHD = 355, CV = 450, All causes = 900

Source: Wright & Fredrickson (1973), p. 17.

In 1971, 674,292 people died from IHD. Mortality from other coronary causes for that year are listed as 357,714 acute myocardial infarction; 4,027 other acute and subacute forms of IHD; 312,351 chronic IHD; 200 angina pectoris; 6,132 chronic disease of the endocardium and other myocardial infarction; 34,250 deaths from all other forms of heart disease (U.S. Vital Statistics, 1971).

III. Demographics

The Health Examination Survey found the following relationships between demographic variables and coronary heart disease.

Age. CHD is rare among young adults in the United States but becomes increasingly common at older ages. Highest prevalence rate is in the age group 65-74 years.

Sex. CHD is more prevalent in males than in females and is more likely to be severe in males.

Ethnicity. Negro and white persons are about equally likely to have the disease.

Socioeconomic status or education. Persons with family incomes over $10,000 have a lower CHD prevalence than persons with incomes under $10,000. No well-defined differences in CHD prevalence are associated with amount of schooling.

The prevalence rate for CHD is less for working men than for retired men and less for working females than for females keeping house.

Urban-rural and geographic region. No well-defined differences are evident by place of residence except that male residents on farms have a lower than average rate of coronary heart disease. In occupational terms, farmers have less CHD than expected.

Marital status. CHD prevalence is less for widowed and divorced men than for other men. For women no differentials associated with difference in marital status are found in CHD prevalence (Coronary Heart Disease in Adults, U.S., 1965).

IV. Etiology

There is no known or agreed upon etiological agent of CHD. Instead there appear to be a number of "risk factors" associated with an increased likeliness to develop the disease.

Elevated serum cholesterol level, hypertension, and diabetes mellitus are the three major agreed upon risk factors for atherosclerotic disease (Kannel, Castille & McNamara, 1967; Stamler, 1967; Rubin, Gross, Arbert & Hutcheon, 1972). The presence in an individual of several risk factors strikingly increases the risk of CHD. In addition to the ones already mentioned, these factors include family history of CHD, smoking, obesity, and lack of exercise (Truett, Cornfield & Kannel, 1967; Griffith, 1971).

Hyperlipidemia. Wright and Frederickson (1973) define hyperlipidemia as a generic term for elevation of one or more of the blood (serum) lipids, i.e., cholesterol, triglycerides, phospholipids."

It appears that with few exceptions, the risk of developing premature CHD increases as the serum cholesterol level rises (Doyle, 1966). Keys (1961) proposes that if any group of middle-aged American males is subdivided into upper and lower halves by serum cholesterol level from a single measurement, the men in the upper category have about three times more risk of developing arteriosclerotic heart disease (ASHD) in the next few years than men in the diets high in saturated fats and cholesterol have high mean serum cholesterol levels. To establish that rich diets increase the mean serum cholesterol level, incidences and mortality rates from premature CHD have been gathered on an international scale. Data from mortality rates for middle-aged males in twenty-two developing countries correlated positively with differences in nutritional factors. A prospective study of eighteen population samples in seven countries involving about 12,000 mean originally 40-59 years of age found that differences in CHD prevalence, incidence, and mortality rates were significantly related to saturated fat intake and serum cholesterol level (Wright and Fredrickson, 1973).

At this point, it can probably be generalized to a large extent that persons who eat the above diet high in sugar and animal fats are also frequently obese. Obesity seems to increase risk especially when other factors are present (Rubin, Gross, Arbert & Hutcheon, 1972). The 1959 Build and Blood Pressure study revealed an 8 to 36 percent higher mortality rate from coronary artery disease in overweight men without any minor impairments. The range was a function of the degree of overweight (Stamler, 1967).

Hypertension. Rubin, Gross, Arbert & Hutcheon (1972) warn physicians that the risk of CHD increases with duration and severity of hypertension. Stamler (1967), citing data from the studies at Framingham, Albany, Los Angeles and the Peoples Gas Co. demonstrates that hypertension in middle-aged American men increases the relative risk of developing clinical CHD. This investigator does not feel that hypertension necessarily is such a risk factor for CHD outside the prevailing conditions of the United States. Human studies with the Japanese and Bantu South Africans and animal experiments where hypertension existed but the diet was low in calories, fats, saturated fats and sugars did not show an associated increase in CHD. When hypertensive animals did eat a high cholesterol and fat diet, hypertension accelerated and aggravated atherogenesis.

Diabetes. Diabetes or even an abnormal response to a glucose tolerance test increases the incidence, morbidity, prevalence and mortality of CHD (Stamler, 1967; Harrison & Reeves, 1968; Rubin, Gross, Arbert & Hutcheon, 1975). Past investigations, according to Stamler (1967), show that diagnosed diabetics more often develop CHD more severely and earlier than nondiabetics. In economically less developed countries where the diet is low in calories, fats, cholesterol and sugars, diabetes does not seem to increase the chances of developing CHD.

Sex. As previously discussed under prevalence, the male is more prone and more likely to develop CHD (Dawber, Moore & Mann, 1957; Stamler, 1967; Moriyama, Krueger & Stamler, 1971; Rubin, Gross, Arbert, & Hutcheon, 1972). The female's relative immunity to CHD is most apparent during her active menstrual life and decreases rapidly either with natural or surgically induced menopause. Incidence of coronary artery disease, according to Rubin et al. (1972) and Stamler (1967), increases up to male incidence after menarche paralleled with a corresponding increase in mortality from the disorder. Death rates in females from CHD remain below the male rate until about age 80 when mortality is about the same for both sexes (Smoking & Health, 1964; Stamler, 1967; Rubin et al., 1972).

Age. The incidence of CHD increases progressively with age, peaking at about 60 years (Rubin, Gross, Arbert & Hutcheon, 1972). While prevalence and age were discussed in the first part of the report, it is sufficient to say that prevalence rate rises with age with the highest rate in the 65-74 year group (Coronary Heart Disease in Adults, U.S. 1965). By the time most Americans reach 50 years of age, they have some degree of coronary artery atherosclerosis (Burch & DePasquale, 1966). McNamara, Molot, Strample and Cutting (1971) found evidence that some degree of coronary atherosclerosis is present in 45 percent of young healthy American males based on their study of Viet Nam combat casualties.

Cigarette Smoking. The following relationships between CHD and cigarette smoking have been made in the Surgeon General's Reports on Smoking and Health (1964) and the Health Consequences of Smoking (1967) and by Stamler (1967).

A strong association has been demonstrated in both retrospective and prospective studies between cigarette smoking and increased CHD morbidity and mortality. This coronary risk is two-to sixfold in the United States and seems to be related to the number of cigarettes smoked. Doyle (1966) in his discussion of cigarette smoking as a risk factor refers to the earlier studies of Framingham and Albany where the combined data revealed a three to five times greater risk of myocardial infarction in middle-aged men for those men smoking twenty or more cigarettes daily than for the nonsmoker.

The Coronary Drug Research Group also found smoking and increased mortality to be connected especially when complicated by ventricular premature beats.

Analysis of 12 year follow-up data from the Peoples Gas Company found cigarette smoking to be the highest risk factor for mortality.

It is generally accepted that cessation of smoking significantly reduces the risk of CHD. Pipe and cigar smokers have a slightly increased risk over non smokers, but they are significantly less at risk than cigarette smokers.

Heredity. A person whose parent or parents experienced CHD has a much greater chance of developing CHD than does a person whose neither parent had the disorder (Rubin et al., 1972). Gertler and White (1954) in reporting the results of the 3 year coronary research project found that proportionately more parents of the CHD group than of the control group died of cardiovascular disorders: 51.3 percent of the deceased mothers and 64.4 percent of the deceased fathers of the coronary heart disease groups as compared to only 35.9 percent of the deceased mothers and 46.2 percent of the deceased fathers of the control group.

CHD in a member of the immediate family also increases the probability of development of CHD by another member. This statement by Rubin, Gross, Arbert & Hutcheon (1972) is again reflected in the above study by Gertler and White (1954) where results showed there were more deaths due to CHD in the families of the heart disease group than in those of the control. In all, 9.8 percent, 37.1 percent, and 8.6 percent of the mothers, fathers, and sibling, respectively, of patients with CHD died from CHD, while 7.7 percent, 18.5 percent, and 1.0 percent, respectively, of the mothers, fathers, and siblings of the control group died from CHD.

Emotional Factors. An acute psychologically stressful experience can precipitate a clinical episode of CHD in persons with severe advanced atherosclerosis of the coronary arteries. Less scientific understanding is available on the relation of stress in modern situations and its effect on the incidence of CHD. Some investigations have shown that acute psychologic stress tends to raise serum cholesterol levels (Stamler, 1967).

In the research of Cathey, Jones, Naughton, Hammarsten and Wolf (1962) a similarity in temperament between CHD patients was observed. All seemed concerned with self-sufficiency and with doing things on their own, usually the hard way. Usually they felt their lives had been a struggle against difficult odds and handicaps. They were oriented toward effort, but took little satisfaction from achievement and no time for enjoyment of the completed task. They seemed to be carrying a constant burden while insensitive to their own limitations. This cardiac characterization inspired Cathey et al., (1962) to remark of the similarity to Sisyphus, the Chaldean king who was condemmed to Hades and required to push a large rock up the side of a hill without ever reaching the summit and so never being able to rest.

The above described complex of emotional reactions is commonly referred to as classical Type A behavioral patterns (Friedman & Rosenman, 1974). In a prospective 4½ year study of 2,998 normotensive males aged 39-59 years it was found that the normotensive, middle-aged male with the fully developed Type B (opposite to Type A) behavior pattern was essentially immune to the development of clinical CHD if he exhibited a serum cholesterol level less than 226 mg/100 ml., a serum triglyceride level less than 126 mg/100 ml, or a serum B/α - lipoprotein ration less than 2.01, singly or in combination (Rosenman, Friedman, Jenkins, Straus & Wurm, 1956).

Exercise. A higher incidence of and a higher mortality from CHD is found in people with a sedentary life-style (Harrison & Reeves, 1968; Rubin, Gross, Arbert & Hutcheon, 1972). A study of Finnish lumberjacks who had a high fat diet but a serum cholesterol similar to a comparative group of townsmen whose fat intake was much lower gives some evidence to the fact that habitual moderately or very heavy physical work gives partial protection to people eating a high saturated fat and cholesterol diet (Stamler, 1967).

Geographic Differences. Death rates for CHD vary considerably for geographical United States. According to Friedman (1967), in 1960, the age adjusted death rate for CHD ranged from 140.1 deaths per 100,000 population in New Mexico to 268.7 per 100,000 in Rhode Island. The highest rates are associated with metropolitan areas. This urban association is reflected in high mortality rates for the northeast section of the country, some of the south Atlantic states and other states with large metropolitan areas such as Illinois. Low rates for CHD are in central United States particularly in the western plains states and in some of the mountain and South Central States.

Schroeder (1960) has tried to give evidence for a negative correlation between 1950 CHD death rates and average water hardness.

Friedman (1967) gathered data to show that CHD death rates for different states are strongly correlated with per capita cigarette sales which he estimated from state cigarette tax revenue.

V. Life Functions

Rehabilitation of the cardiac patient is the process concerned with the full development of each person's physical, mental, and social potential designed to restore him to a maximally productive, active, and satisfying life as soon as possible after the recognition of cardiac disease.

It begins with helping the patient to live with his physical restrictions. The emotional stresses of fear, anxiety, tension, frustration, hostility, depression, rage, hate, and love brought on in the patient by the physical condition must be dealt with by the patient himself with help from the physician and in severe cases the advice of other health professionals.

A task force on cardiovascular rehabilitation, the National Heart and Lung Institute, (1974) has suggested that approximately half of the individuals who have a heart attack survive with varying degrees of residual physiological, psychological, and/or sociological (including vocational) impairment. To help meet the individual needs and thereby rehabilitate the person, individual management is necessary. Briggs (1972) suggests that rehabilitation must be developed not only around the etiology of the disease but also the functional level of which the patient is capable. In other words, it is necessary to rehabilitate the heart and the patient.

With this in mind, "Cardiac rehabilitation may be defined as the art and science of restoring a person to that level of physical and mental activity compatible with the functional capacity of his heart" (Zohman & Tobis, 1970).

To assess the degree of physical activity disability, the New York Heart Association classifies heart patients by the following functional capacity and therapeutic classifications (Gajewski, 1965; Rubin, Gross, Arbert & Hutcheon, 1972).

Classification of Cardiac Patients - Functional Capacity

Class I

No limitations of physical activity.

No symptoms with ordinary physical activity.

Class II

Slight limitation of physical activity.

Symptoms occur with ordinary physical activity.

Class III

Marked limitation of physical activity; comfortable at rest.

Symptoms occur with less than ordinary physical acitivity.

Class IV

Symptoms with any physical activity and may occur at rest.

Symptoms increase in severity with any physical activity.

Therapeutic:

Class A

Physical activity not restricted.

Class B

Ordinary physical activity not restricted.

Severe or competitive physical activity not advised.

Class C

Ordinary physical activity moderately restricted.

Strenuous activity discontinued.

Class D

Ordinary physical activity markedly restricted.

Class E

Complete rest advised.

Confined to bed or chair.

The Functional Classification is assigned by the physician largely on the basis of historic information obtained in an interview with the patient. Threshold, intensity and duration of symptoms as well as limitations on activity caused by the symptoms are subjectively related by the patient to the doctor who then classifies the patient in increasing severity from I through IV.

Therapeutic classification is reflective of the physician's judgment of objective findings. This section of increasing severity from A through E is dependent not only upon the technical skill and clinical experience of the physician but also upon his ability to elicit from the patient a history of limitations caused by symptom discomfort and the course of illnesses (Bruce, 1957; Hagan, 1966).

Bruce (1957) found it helpful to add the criteria of the need for additional rest as determined by the patient and the physical ability to perform customary activities on the regular full-time schedule in contrast to self-imposed limitations. These two criteria aided in the differentiating of patients into the intermediate Classes II and III by reducing the effects of differences in patient awareness of symptoms as well as variations in "ordinary" energy requirements (Table 2-3).

TABLE 2-3

CLINICAL EVALUATION OF FUNCTIONAL CAPACITY OF CARDIAC PATIENTS IN RELATION TO ORDINARY PHYSICAL ACTIVITY

(Modified from New York Heart Assoc., 1953)

Class	Cardiac symptoms	Limitations	Need for Additional Rest*	Physical Ability to work+
I	None	None	None	Full time
II	Only moderate	Slight	Usually only slight or occasional	Usually full time
III	Definite, with less than ordinary activity	Marked	Moderate	Part time
IV	May be present even at rest, and any activity increases discomfort	Extreme	Marked	Unable to work

* To control or relieve symptoms, as determined by the patient rather than advised by the physician.

+ At accustomed occupation or usual tasks.

Geriatrics, Bruce 1957, p. 318

Table 2-4 is based on data collected by Bruce (1957) from 96 patients out of 206 who were found to have coronary artery disease without hypertension. Of the portion not employed, 55 percent were psychiatrically normal, while 81 percent had a psychiatric diagnosis. Table 2-5 shows the signs and symptoms exhibited by the 96 patients during the exercise test. Only 70 percent of the exercise tests were in agreement with the clinical appraisal of functional capacity as shown in Table 2-6. This table also illustrates probable reasons for the discrepancies between the clinical and laboratory evaluation. The information in Table 2-6 does not reflect the psychiatric estimate of the motivation to work.

TABLE 2-4

CLINICAL CHARACTERISTICS OF CORONARY ARTERY DISEASE

Functional capacity	I	II	III	All
Number of patients	16	52	28	96
Currently working	4	10	3	17
Average age in years	53	49	56	51.6
Previous infarction	10	37	17	64
Angina Pectoris	4	32	19	55
Cardiomegaly	2	8	11	21
Physical restrictions	13	49	24	86
Digitoxin	2	5	9	16
Nitroglycerine	3	21	19	43

Source: Bruce, 1957

Of 29 patients for whom discrepancies were evident, three lacked the motivation to take part in the test procedure. A psychiatrist considered 20 out of the remaining 26 of that group to have no motivation to work. The data on work prescription highlights the suggestion that many cardiacs are overprotected by their own self-limitation or by their exaggerated history of symptoms which may be reflective of an inappropriate motivation for rehabilitation (Bruce, 1957).

TABLE 6-5

EXERCISE RESPONSES WITH CORONARY ARTERY DISEASE

Functional capacity		I	II	III	TOTAL
Number of patients		16	52	28	96
Anxiety		1	26	19	46
Dyspnea		5	35	25	65
Chest pain		0	19	15	34
Fatigue		2	12	15	29
Endurance* in minutes		10±0	8.0±2.6	6.0±3.2	
Hypotension		0	1	3	4
Systolic rebound		0	0	3	3
Exercise	VPS	0	3	2	5
	ST	1	3	2	6
	T	3	7	8	18
Recovery	VPS	0	5	2	7
	ST	0	10	9	19
	T	1	12	9	22
Physical fitness index*		16.6±1.3	14.9±6.2	9.1±6.4	

*Mean ± Standard Deviation

Source: Bruce, 1957.

TABLE 2-6

CLINICAL CORRELATION WITH EXERCISE TOLERANCE AND WORK PRESCRIPTION

FUNCTIONAL CAPACITY	I		II		III		All
Number of patients	16		52		28		96
Relationship to PFI*							
Agreement	13		34		20		67
Disagreement	3		18		8		29
Discrepancies due to:							
Unsatisfactory history	2		11		6		19
Limiting self	1		2		1		4
Medical restrictions	0		0		1		1
Recent convalescence	0		2		0		2
Validity of test							
Due to other disease	0		1		0		1
Due to errors	0		2		0		2
Work prescription							
Unemployable	0		0		4		4
Agency referral	3		17		8		28
New job	2	81%	4	66%	2	57%	8
Modified job	2		17		12		31
Same job	9		14		2		25

* PFI - physical fitness index

Bruce, 1957, p. 324

Mobility. The before mentioned classification of cardiac patients by functional capacity and therapeutic classification (New York Heart Association), exhibits the wide range of ability of the cardiac patient to move in a working or living environment. For a person who has experienced an uncomplicated myocardial infarction the usual plan for recovery of mobility includes one month of complete rest, followed by one month of slowly increasing activity, and then a transitional period of increasing activity to normal levels with a return to work, if possible, during the third month or fourth month depending on the type of job. For patients with complications, which generally means that there has been damage to the myocardium, longer periods of bed rest and a longer period of convalescence is required. Activities that produce angina or signs of congestive heart failure must be avoided. Thus a CHD patient might find that a short walk tires him or he might have to be driven somewhere instead of getting there on his own or by public transportation (Gajewski, 1965; Rubin, Gross, Arbert & Hutcheon, 1972).

TABLE 2-7

LIFE FUNCTION TABLE--CHD: MOBILITY

Statement of Problem	Dynamics	Source
Limitation on physical acitivity.	Recognition of CHD-recovery to Class IA.	Zohman & Tobis, 1970
Inability to drive or ability to drive only certain type vehicles.	Onset of symptoms. Subject to medical review.	Bellet, Roman et al., 1968. Rubin, Gross Arbert & Hutcheon 1972.
Social Restrictions-Recreation.	Discovery of CHD.	No research Thompson, 1966.
Restrictions on Air Travel.	Discovery of CHD. Never pilot an airplane.	No research, Brandaleone.

Health Functions. Depending on the number of previously discussed risk factors and the severity of CHD that a patient has, more of his attention must be paid to preventing the disorder from worsening. The pain of angina often acts as a safety valve warning the patient that the activity is too strenuous or the level of stress is dangerously high. In most instances, a rest period during which nitroglycerin is taken will be enough to make the pain cease.

Extreme temperatures should be avoided. Brouha and Burch have shown that the heart becomes less efficient as the temperature rises. This increase in work plus the fact that recovery from the increased demands is slowed by temperature and humidity, negatively influence performance and can have after effects on the person with CHD (Ellestad, 1975). Winter especially is a problem to the CHD patient as a cold wind can easily induce angina which could progress to a myocardial infarction.

Elimination or reduction of risk factors should be encouraged. This is often accomplished by the administration of certain drugs, adherence to a special diet or by cessation of smoking. These actions are often a source of additional problems for the patient. Drugs to control hypertension often cause the side-effects of photosensitivity or increased urinary urgency. Adherence to a low fat, low cholesterol diet can cause problems when the rest of the family eats foods that the person with CHD should avoid. Overeating must be avoided both to maintain weight and to prevent precipitating attacks of angina which can be caused by a heavy meal. Meals should be light with no exertion till about one hour after the meal (Rubin, Gross, Arbert & Hutcheon, 1972). If a person quits smoking or tries to modify his smoking habit, there is often a great deal of resultant emotional stress.

Every CHD patient must live with the knowledge that CHD can also cause mortality. Some patients succeed more successfully than others by not succumbing to the disorder or in enjoying life despite their condition.

TABLE 2-8

LIFE FUNCTION TABLE--CHD: HEALTH

Statement of Problem	Dynamics	Source
Pain associated with angina.	After strenuous exercise; too heavy a meal; exposure to cold wind; stress at night.	Gelfand, 1966; No research, Harrison & Reeves, 1968. Rubin, Gross, Arbert & Hutcheon, 1972.
Increased mortality risk.	From discovery of CHD.	Gertler, White, Simon & Gottsch, 1964. Dimond, 1963.
Tiredness: patient often complains of becoming tired with small amount of activity.		No research.
Controlled diet: achieve and maintain normal weight; avoid foods high in animal fat.	Throughout life.	Ahrens, 1966; Harrison & Reeves, 1968; Robinson, 1972.
Dyspnea - on exertion or at night.	After myocardial infarction or development of CHD.	No research, Harrison & Reeves, 1968; Rubin, Gross, Arbert & Hutcheon, 1972.
Inability to perform sexual act due to fear or physiological state.	First 10 weeks after onset.	Briggs, 1972; Hellerstein & Freedman, 1970; Greenberg, 1965; Naughton, 1966; Rubin, Gross, Arbert & Hutcheon, 1972.

TABLE 2-9

LIFE FUNCTION TABLE--CHD: COMMUNICATION

Statement of Problem	Dynamics	Source
Not applicable		

TABLE 2-10

LIFE FUNCTION TABLE--CHF: COGNITIVE-INTELLECTUAL

Statement of Problem	Dynamics	Source
Not applicable		

Social-attitudinal. CHD in a majority of cases forces a person to change or modify his life to some degree. Many people who previously thought they were healthy, now are suddenly forced to live with a disorder. Still others have probably come close to dying and worry about their increased risk of mortality. A CHD patient worries what influence the disease will have on his life role as a parent, breadwinner, spouse or employee. A few fall prey to feeling sorry for themselves and withdraw, while many others set out to prove they are as good as before their attack or as able-bodied as the next person. Such overextension of themselves is characteristic of the Type A behavior pattern (Rosenman, Freedman, Jenkins, Straus & Wurm, 1956).

TABLE 2-11

LIFE FUNCTION TABLE—CHD: SOCIAL-ATTITUDINAL

Statement of Problem	Dynamics	Source
Type A behavior.	Till personally controlled.	Cathey, Jones, Naughton, Hammersten & Wolf, 1962; Friedman & Rosenman, 1974.
Psychological stress: Resulting from cessation of smoking, coffee drinking.	While trying to break bad health habits.	No research, Harrison & Reeves, 1968.
Diminished self-esteem.	Heart attack to psychological rehabilitation.	
Anxiety tension state.	Heart attack to point where he has learned to live with his disorder.	No research, Howard, 1971.
Inability to return to former job.	Vocational rehabilitation.	Gelfand, Lewis, et al., 1960.
Development of a significant degree of depression.	Temporary after MI; often many months later.	Hellerstein & Hornstein, 1966.
Feminization of the male coronary patient.	Convalescent period onward.	Gelfand, Lewis, et al., 1960.

VI. Functioning as a Member of Society

The literature provides information about function in the labor force and community by persons with coronary heart disease.

Functioning as a Member of the Labor Force

A report of the task force on cardiovascular rehabilitation of the National Heart and Lung Institute (1974) estimates that about 80-90 percent of patients who experience an uncomplicated acute myocardial infarction and survive for one year after the attack, return to work. Three-fourths of these workers return to their old jobs. Younger workers with the least impairment are the most likely to successfully return to their former occupation.

Although most men who have a good recovery from myocardial infarction will have further manifestations of coronary heart disease, many men will be symptom-free and able to work between the initial attack and their death or retirement. The New York Central Railroad adopted a policy of returning operating personnel to full term work after a myocardial infarction if cleared for work by an internist. Of this group, approximately 5 percent of the men who returned to work were subject to another heart attack annually during the first five years, of which half of these reoccurrences were fatal. Since a majority of these fatal attacks occurred suddenly, the deaths of these workers highlighted the practice of not returning a person who has experienced a heart attack to a job where his sudden death could cause harm or death to other people (Dimond, 1963).

Not all workers do, or are able to return to work for a variety of reasons. If a person is close to retirement age, he will sometimes use his heart condition as an excuse to retire early. Others cannot return to their former jobs because it is too physically or emotionally stressful. Still others were competing in a tight job market before and their heart condition and loss of time due to recovery put them at a greater disadvantage in finding work than a healthy individual who has stayed in the job market.

Workmen's compensation and social security benefits sometimes are an incentive not to get better as compensation benefits often depend on the extent of disability. If the worker experiences his heart attack on the job, workmen's compensation laws will generally rule that the attack was caused by the job and therefore compensable. Since the employer can and usually is held responsible, industry generally refuses to hire people with known heart disease and refuses to hire older people because of their higher incidence of coronary heart disease (Rubin, Gross, Arbert & Hutcheon, 1972; National Heart and Lung Institute, 1974).

While a union will sometimes fight for re-instatement and seniority rights of a worker with a good record, it will not always to the same for a worker with a poor record. Union rules sometimes become a major hindrance when a person who has experienced a heart attack is forced to change jobs. Loss of seniority and having to start at the bottom or loss of retirement years often discourages many men from returning to work. Sometimes if a person is able to stay with the same company and must change jobs within the company some of these problems can be eliminated (National Heart and Lung Institute, 1974).

Vocational counselors and physicians alike may utilize energy cost tables to determine if a patient can return to his former job, or to determine what type of work is now suitable. When a patient can and does return to his job, he will be forced, by his physical limitations, to take it easy at first. Realization of this handicap by his fellow workers will do much to help the person adjust to working again. Care must be taken that a patient does not try to overextend himself too soon in an effort to prove he's as good as new if not better, or adopt behavior at the other extreme--never resuming full job duties in order to spare himself. This attitude will, at the very least, have a negative effect on his fellow workers.

Functioning as a Member of the Community

The experiencing of an acute myocardial infarction is usually frightful and emotionally upsetting both for the patient and his family.

Especially if the patient seemed to be in good health prior to the episode, it affects his friends and fellow workers who begin to think that they may be next.

During recovery and later convalescence, the patient normally feels severely injured as he worries about the effect his disorder will have on his role as parent, spouse or worker. Often a person will wonder why he developed heart disease just when he had so much left to do with his life.

When the patient returns home for the convalescent period, he must be careful not to overexert himself and to get plenty of rest. At this stage family members can be of immense support by helping the patient without babying him and by consideration for the person who is still not recovered.

After a month of rest at home, the patient should be gaining back his strength by doing tasks around the house and by taking short walks. If the patient is a male, he will often feel he is losing his masculinity by helping with the housework and by the fact that he is not working while other family members work, or worse if his income is the sole source, seeing the family struggle to make ends meet. Family members must not enforce this negative thinking by either their words or attitudes. The patient should be encouraged to regain his former physical strength and activity to as great a degree as possible (Gelfand, n.d.)

Usually about the tenth week after the heart attack, a patient can resume sexual activities. Both the patient and his spouse should be reassured that as long as the patient, for the most part, takes a passive role and does not overexert himself, no harm should result from the episode. In fact often the resumption of sexual activities will do much to speed the recovery of the patient (Greenberg, 1965; Naughton, 1966; Hellerstein & Freedman, 1970; Briggs, 1972; Rubin, Gross, Arbert & Hutcheon, 1972).

VII. Technologies

Restorative Technology--Cardiac Surgery (Rubin, Gross, Arbert & Hutcheon, 1972).

Cardiac transplantations (Rider, Copeland, et al., 1975).

Biopsy (Caves, Stinson et al., 1975).

Pacemakers.

Prosthetic heart, blood pumps (heart lung machine), artificial heart parts (blood vessels, valves), auxiliary or booster hearts, physiological feedback control systems, monitors, increased use of computers.

Heart transplant.

Training Technology--Exercise Stress Testing Program (Naughton, 1966; Krusen, Kottke & Ellwood, 1971).

Individual psycho-therapy.

Biofeedback (Shapiro, Schwartz, & Benson, 1974).

Behavior modification.

Group therapy - Heart Clubs.

Social caseworker, homemaker services (Jefferson, 1966).

Education of the patient, family and public about coronary heart disease and the cardiac patient.

Vocational rehabilitation (Hagan, 1966; Krusen, Kottke & Ellwood, 1971).

Cardiac Work Evaluation Units (Rehabilitation Committee; American Heart Association, 1963; Whitehouse, 1966).

Primary prevention (Wright & Fredrickson, 1973) (Table 2-12).

Technologies for cardiac-control (Clipson & Wehrer, 1973).

Advice to the coronary farmer - U.S. Agricultural Extension Service,

TABLE 2-12

CORONARY HEART DISEASE

GUIDELINES FOR PREVENTION AND CURE

Recommendations for Prevention:

A. A National Policy Commitment to a Strategy of Primary Prevention.

B. Definite Field Trials of Primary Prevention

C. Diet and Food Modifications

1. Calories adjusted to achieve and maintain optimal weight
2. Reduce cholesterol (dietary $\leq$ 300 mg/day)
3. Reduce dietary saturated fats
4. Meats - produce low in saturated fats
5. Dairy products - reduce fat and cholesterol content
6. Baked goods - reduce saturated fat, cholesterol and calorie content
7. Fats and oils - promote use of fats and oils low in saturated fats and cholesterol
8. Egg yolks - reduce consumption
9. Food labeling
10. Government programs and nutrition programs - schools, V.A. facilities - better eating habits.
11. Public and professional nutrition information

D. Elimination of Cigarette Smoking

1. Advertisements and sales to young
2. Mass media education program of hazards
3. Education programs in the schools
4. Cigarette vending machines - not in medical facilities, banned from public buildings.
5. Smoking in public facilities - no cigarettes in meetings, mass transit.
6. Use of tobacco tax funds - tax increase, program control, description of smoking
7. Government subsidies for tobacco cultivation and export
8. Socioeconomic planning for the phaseout of the cigarette industry

E. Detection and control of hypertension

F. Community programs - determine and treat those susceptible to premature risks.

G. Drug treatment of hyperlipidemia and exercise program

Source: Wright & Hendrickson, 1973

Federal Extension Service (Morris, 1966).

Environmental Change Technology--Any environmental influence associated with Type A behavior that has to be changed to encourage Type B behavior in an individual (Friedman & Rosenman, 1974). For example, moving to the country, changing jobs.

Workshops (Jezer, 1966).

Modification of recreational activities, community resources (Thompson, 1966).

VIII. Service Delivery

Hospital: Coronary Care Unit (Hoflendahl, 1970; Clipson & Wehrer, 1973). Outpatient cardiac care.

Community: Community Stratified Systems of Coronary Care. Life support units at the work place, office building, airports, stadiums. New types of transport including ambulances and helicopters. Open heart surgical units and Mobile Coronary Care units. Important adjuncts of the system include a public and professional education program to decrease the interval between the onset of symptoms and the decision to seek medical care and the development of local mechanisms to facilitate rapid entry into the coronary care system. It cannot be overemphasized that the cornerstone of this system is organized, continuing, community planning for effective coordination of all components so that the combination of resources provides the best comprehensive cardiovascular care attainable under existing circumstances.

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CHAPTER 3
DISABILITY ANALYSIS: EMPHYSEMA

I. Definition

Pulmonary emphysema, and the related lung disease of chronic bronchitis, have been the subject of some dispute in recent years concerning the nomenclature used to describe this condition. Various terms such as chronic obstructive pulmonary disease (COPD), chronic obstructive lung disease (COLD) chronic airways obstruction, and various other terms have been adopted to describe the condition. Others have relied on the specific terms pulmonary emphysema, and/or chronic bronchitis. Prior to proceeding with a discussion of the specific characteristics and effects of this disease, it is; therefore, necessary to clarify this confusion in terminology.

The word "emphysema" is derived from a Greek word meaning "blown up." Emphysema has subsequently come to be generally defined as an anatomic disorder. This disorder is characterized "by an increase beyond the normal in the size of air spaces distal to the terminal bronchioles [of the lung] with destructive changes in their walls" (Baum, 1974). This anatomical definition, stressing an abnormal increase in the size of air spaces in the lung tissue with the inclusion of destruction of the walls of air spaces, has become the accepted medical definition of emphysema (Stedman, 1972; American Thoracic Society, 1962; American Lung Association, 1975; Dorland, 1974).

The problems in nomenclature have generally resulted from the use of different criteria for diagnosis of the disease. As the strict definition implies an anatomical defect which is not apparent until post-mortem autopsy, some have preferred to rely solely upon clinical criteria in diagnosing the disease and, thus, have labeled it as chronic bronchitis. Others have inferred anatomical obstruction from the clinical diagnosis and thus refer to the condition as pulmonary emphysema and chronic bronchitis or solely pulmonary emphysema. Others have insisted on a more functional definition resulting in the terms chronic obstructive lung disease, chonic obstructive pulmonary disease, chronic urinary disease, and similar terms (Cumming and Semple, 1973). Some researchers in the area have disputed those functional terms as descriptive of only the later stages of the disease, and not applicable to the mild or moderate stages when technically obstruction of the airways is not present (Rodman and Sterling, 1969).

This debate over nomenclature is still far from settled, and the various terms continue to be found throughout the current medical literature. In this report, the term pulmonary emphysema will be used in order to refer to the more serious, or chronic form, of obstructive pulmonary disease.

Functionally, the primary characteristics of pulmonary emphysema is dyspnea, or shortness of breath, which is caused by the difficulty in expelling air from the lungs and the consequent poor distribution of inhaled air through the lungs (American Lung Association, 1975). Several different types of emphysema have been identified, only some of which are disabling. Senile or alveolar emphysema is a characteristic of the aging process in which the lungs typically become distended and less functional. Compensatory emphysema refers to emphysema due to a surgical removal of part of the lung tissue resulting in an expansion of the remaining lung tissue in order for the lung to function adequately (Farber and Wilson, 1968). These types of emphysema are generally not disabling and, hence, will not be dealt with in this discussion.

The two principal types of pulmonary emphysema generally agreed upon in the medical literature are: 1) centrilobular emphysema (CLE) and 2) panobular emphyseam (PLF). (These types are based primarily upon the morphology of the emphysema and may often be found to co-exist in the same lung or lobe [National Tuberculosis and Respiratory Disease Association, 1972]). Nevertheless, the two types have distinctly different characteristics.

Centrilobular emphysema tends to be unevenly distributed throughout the upper lung. This type of pulmonary emphysema is found much more commonly in males than in females, is usually associated with chronic bronchitis, and is seldom found in non-smokers. Panobular emphysema, in contrast, is characterized by a uniform enlargement and destruction of the alveoli in the lower lung. It occurs as commonly in women as in men and is characteristic of a type of emphysema developed due to a hereditary deficiency of a serum alpha_1-antitrypsin. This type of emphysema is less common than the centrilobular type (National Tuberculosis and Respiratory Disease Association, 1972; Baum, 1974).

A final, less prominent, category of emphysema is focal emphysema which is associated with coal dust and is generally restricted to those in the coal mining industry (Baum, 1974). These various types of emphysema have been delineated in the medical literature primarily as a means of describing certain patterns or characteristics common to each type; however, in many, if not most cases, different forms of emphysema are found to occur in the same individual, although one type may predominate. This is particularly true with panobular and centrilobular emphysema (Baum, 1974; National Tuberculosis and Respiratory Disease Association, 1972).

A final word here seems necessary concerning the relationship between pulmonary emphysema and chronic bronchitis. It was originally believed by many researchers in the field that chronic bronchitis was a precursor of pulmonary emphysema, and this is, in fact, often the case. The two conditions are closely related; however, it is as yet unclear whether emphysema may be a complication of bronchitis or bronchitis complication of emphysema. Each condition does, in fact, frequently occur in the absence of the other. At this time, the relationship between the two diseases has not been clearly established although they are frequently grouped together in discussions of obstructive lung disease (Cumming and Semple, 1973).

II. Societal Characteristics of Persons with Emphysema

The literature provides information about prevalence and incidence of persons with emphysema.

Incidence and Prevalence

In the last decade, chronic obstructive pulmonary diseases, and most particularly pulmonary emphysema, have shown a startling increase in disability and mortality rates. This is due partially to a change in physicians reporting of the primary cause of death, but nevertheless, reflects a real increase in incidence of the disease.

The most recent incidence figures available as measured by non-referred first visits to private physicians indicate 289,000 cases of emphysema diagnosed in 1974 (American Lung Association, 1975). A three year average of incidence figures from 1972-1974 when compared with identical figures from 1962-1964 reveal a 12% increase from 122.4 cases per 100,000 in 1962-1974 to 137.1 cases per 100,000 in 1972-1974 (American Lung Association, 1975).

Prevalence figures indicate that chronic obstructive pulmonary disease, combining emphysema and chronic bronchitis, affects approximately 7.8 million Americans in 1973. This includes 1.3 million victims of pulmonary emphysema and 6.5 million victims of chronic bronchitis (National Heart and Lung Institute, 1975). A national health interview survey by the American Lung Association in 1970 revealed a figure of 1,313,000 cases of pulmonary emphysema with 44.9% of these cases being severe enough to cause a limitation in activity. It appears that this survey is the only source of a figure and that everyone in the field accepts the 1.3 million estimate. This survey demonstrates the age distribution in emphysema cases reporting that only 136,000 of these 1.3 million cases are found in individuals under the age of 45, while the remaining 1,777,000 cases occur in individuals of 45 years or older. The combined incidence-prevalence figures of pulmonary emphysema and chronic bronchitis indicate that chronic obstructive pulmonary disease is the most prevalence pulmonary disease in the United States with its incidence exceeding that of tuberculosis and lung cancer (Rodman and Sterling, 1969).

Autopsy figures reveal an even higher incidence of true pulmonary emphysema. See table 3-1. As pulmonary emphysema is often difficult to diagnose prior to the severe stages, these figures present a picture of the true prevalence of pulmonary emphysema, given accurate diagnosis. While most of these patients died from other ailments, emphysema was anatomically apparent in 41.3%.

The actual cost of pulmonary emphysema in societal terms is most apparent in the current disability figures. Recent figures indicate that emphysema disables one out of every 14 wage earners over 45 years of age (National Heart and Lung Institute, 1975). Among diseases of the respiratory system, emphysema is the most prevelant cause of disability, with 18,132 workers having a primary diagnosis of pulmonary emphysema claiming Social Security disability benefits in 1971 (American Lung Association, 1975). Of all primary diagnoses, pulmonary emphysema was the third leading cause of disability in 1971, the most recent year for which figures are available. At this time, pulmonary emphysema was the diagnosis in 5% and was exceeded only by heart disease and mental illness (American Lung Association, 1975). The disability benefits from these claims amount to more than $400 million a year.

Mortality figures from pulmonary emphysema further reveal the recent increase in incidence of the disease and its emergence as a major public health problem (Rodman and Sterling, 1969). Comparison of mortality figures from 1974 and 1964 indicate a 12% increase from 8.3 to 9.3 per 100,000 in the number of deaths in which chronic respiratory disease is listed as the

TABLE 3-1

PREVALENCE OF EMPHYSEMA AT AUTOPSY (INFLATED LUNG TECHNIQUE)*

	Male	Female	Total
Number of patients	77	73	150
Percentage of patients	52%	48%	100%
Average age	60.8 yrs.	61.4 yr.	61.1 yr.
Prevalence of emphysema	64%	17%	41.3%

*From Thurlbeck, M. M.: The diagnosis of emphysema, Thorax, 1954, 19:571.

primary cause of death. In raw figures, this was an increase from 15,796 deaths from pulmonary emphysema in 1964 to 19,740 deaths in 1974 (National Heart and Lung Institute, 1975). While this increase is partially due to a greater tendency on the part of physican's to list this disease as a primary rather than contributing cause, it is believed that these figures continue to underestimate the number of deaths from chronic respiratory disease as death often occurs as a result of complications associated with the disease and these other complications are often listed as primary causes of death.

Other mortality figures, however, further confirm the increase in deaths due to pulmonary emphysema. Figures collected by the National Tuberculosis and Respiratory Disease Association indicate that in the decade ending in 1970 deaths attributed specifically to pulmonary emphysema increased by 145% from the previous decade. Further, the ratio of reported deaths from pulmonary emphysema and lung cancer rose from one to 15 in 1950 to one to 2.6 in 1967. The most recent figures from the early 1970's reflect a slight reduction in the number of deaths reported due to pulmonary emphysema and chronic bronchitis, perhaps due to better diagnostic and treatment facilities. However, the disease remains a major health problem in the United States, particulary as a source of long-term disabilities (National Heart and Lung Institute, 1975).

III. Demographics

Pulmonary emphysema is primarily a disease of white men over the age of 50. Clinically severe emphysema is 10 times as common in men as in women (American Lung Association, 1975; National Tuberculosis and Respiratory Disease Association, 1972). Some researchers believe this sex difference in incidence is due to a genetic difference in susceptibility to the disease (Rodman and Sterling, 1969).

Most victims of pulmonary emphysema have been heavy cigarette smokers (defined as 20 or more a day) for the duration of their adult lives (Rodman and Sterling, 1969). Emphysema is 13 times more prevalent among cigarette smokers than among non-smokers (National Heart and Lung Institute, 1975).

The patient's living environment, urban or rural, and his social class play a more minor role. Emphysema tends to be more common among those living in urban rather than rural areas; this may be a result of the contributory influence of air pollution (National Heart and Lung Institute, 1975). Likewise, the disease is slightly more common among the lower socio-economic classes. This may be due to either greater exposure to industrial air pollution or to less attention given to respiratory infections (Enterline, 1967).

IV. Etiology

While the exact cause of pulmonary emphysema is unknown several factors have been found to be closely related to the incidence of the disease. The major factors which have been identified and will be discussed here are: 1) cigarette smoking, 2) air pollution, 3) occupation, 4) frequent respiration infections, and 5) heredity.

Of these factors, by far the most important is cigarette smoking. Heavy cigarette smoking is generally accepted as the major cause of both chronic bronchitis and pulmonary emphysema. Although the physiological cause-and-effect relationship between cigarette smoking and pulmonary emphysema is unknown, statistics reveal smoking to be a major factor in the incidence of these diseases. As mentioned, pulmonary emphysema is 13 times more prevalent among cigarette smokers than among non-smokers. In addition, for those victims of pulmonary emphysema, the death rate among smokers is seven times that of non-smokers (National Heart and Lung Association, 1975). Virtually every study examinimg etiological factors associated with pulmonary emphysema has found heavy cigarette smoking to be related to incidence and severity of the disease (American Lung Association, 1975). However, while this relationship has been clearly demonstrated, it appears unlikely that cigarette smoking alone is responsible for the onset of the disease due to the substantial number of heavy smokers who never contract the disease and the significant number of non-smokers who do (Baum, 1974). Additional evidence in support of this position, is provided by the fact that it has been discovered to be most difficult to produce chronic obstructure pulmonary disease in laboratory animals solely through the inhalation of cigarette smoke (Baum, 1974). Thus, while cigarette smoking is, numerically, the most important precursor of chronic obstructive pulmonary disease in the United States, it does not appear to be the sole contributory factory, and in fact, it is still questionable whether it is a cause of simply a correlate.

A secondary cause, although much less important statistically than that of cigarette smoking is air pollution (National Heart and Lung Institute, 1975; Belinkoff, 1971; American Lung Association, 1975; Rodman and Sterling, 1969; National Tuberculosis and Respiratory Disease Association, 1972). The exposure to initiating fumes and dust has been found to be more of an aggravation to a pre-existing condition than a major cause of the disease in the United States. A major study involving 1,500 male telephone workers in four areas of the United States and Japan found age and cigarette smoking to be the major factors in prediction of pulmonary emphysema while place of birth, home and employment did not contribute to prediction of the disease (National Heart and Lung Institute, 1975). In Britain, however, where the incidence of severe chronic obstructive pulmonary disease among smokers is six times as common as in the United States and the mortality rate is 30 to 40 times higher, air pollution is viewed as a major factor (Rodman and Sterling, 1969).

The findings covering the etiological factor of occupation are similar to those of air pollution. While it is believed that those who work in environments in which they are exposed to more noxious fumes and dust will be more likely to contract emphysema, research studies have shown this to be a minor factor, with the exception of focal emphysema, which is specifically associated with coal dust. In contrast to the association of pulmonary emphysema with more industrial occupations, Rodman and Sterling (1969) point out that many patients with the most severe cases have been employed in rather sedentary occupations which have allowed them to ignore their symptoms of breathlessness for some years.

Another hypothesized factor in the incidence of pulmonary emphysema is the frequent occurrence of respiratory infections (National Tuberculosis and Respiratory Disease Association, 1972). W. W. Holland (1963) has even suggested that the disease may have its roots in childhood with the repeated occurrence of respiratory infections setting the substrata for the later disease. It has been demonstrated that patients with chronic obstructive pulmonary disease are more prone to bronchopulmonary infections (National Tuberculosis and Respiratory Disease Association, 1972). However, most researchers consider the role of bacterial infection in the instigation of the disease to be of minor importance (Rodman and Sterling, 1969). The complications caused by respiratory infections when occurring in conjunction with pulmonary emphysema are of great importance and will be discussed in a later section, but these are not considered as etiological factors.

A final, but neverthless, important etiological factor in pulmonary emphysema is a hereditary factor. In the last decade it has been found that a hereditary deficiency in serum alpha-antitypoin which is transmitted by a, autosomal, dominant gene is an important pathogenic factor in certain types of emphysema (Fagerhol and Gedde-Dahl, 1969). Homozygotes, or individuals who inherit two alleles for this condition, tend to develop severe panobular emphysema during their early adult years (National Tuberculosis and Respiratory Disease Association, 1972). This condition differs from the more common centrilobular emphysema, but is equally serious. The homozygous condition, however, is relatively infrequent occurring in a ratio of 1:1,500 or 1:1,200 persons (Baum, 1974). The heterozygous, or intermediate condition in which one recessive and one dominant allele are inherited, is, in comparison, much more common and considered important etiological factor than the homozygous condition. The heterozygous condition is found in approximately 4.7% to 5% of the population, and current research suggests that these individuals may be more susceptible to centrilobular emphysema (Fagerhol and Gedde-Dahl, 1969; Emphysema-Killer at Large, 1973; National Tuberculosis and Respiratory Disease Association, 1972). It has been demonstrated that those persons with the intermediate, or heterozygous, condition who smoke are, in fact, more susceptible to emphysema than other smokers (Kayton, Fallat, and Cohen, 1975).

The importance of the heredity factor in the etiology of emphysema is not completely understood, although this is and has been a major area of investigation in the last few years (Baum, 1974). The number of emphysema patients who have either a homozygous or heterozygous deficiency is not known. It is know that people with the homozygous deficiency are more likely to have panobular emphysema (National Tuberculosis and Respiratory Disease Association, 1972). However, not all patients with the deficiency actually contract the disease. Those patients with the heterozygous condition are as stated, more susceptible, to centrilobular emphysema, which is the most common type of emphysema; however, it is not known how many individuals with the heterozygous condition have emphysema or, conversely, how many emphysema patients have the heterozygous deficiency. Thus, the impact of the genetic factor in all cases is unknown. Some researchers believe that the etiological basis for emphysema is an interplay between various environmental factors (smoking, air pollution, bronchial infection) and genetic factors (Baum, 1974). Further research is necessary in order to conclude how these factors interact and the significance of each.

These then are the primary etiological factors associated with pulmonary emphysema. With the exception of the heredity factor, none of the factors serve to explain the exact physiological basis for the genesis of pulmonary emphysema. While this remains unknown, the incidence of pulmonary emphysema as a major health problem in the United States continues. As pulmonary emphysema is frequently a disabling disease of an irreversible nature which may persist for years it presents special problems in the area of treatment and its effect upon various life functions.

V. Life Functions

The psychological, social, and economic consequences, as well as the physical effects, of pulmonary emphysema are enormous. In its moderate to advanced stages, the disease often "renders entirely ineffectual the breadwinner of a family and maintains this subjugation for years" (Cumming and Semple, 1973, p. 41). Of the five life function areas to be covered in this discussion, the only area in which the patient with severe pulmonary emphysema is not affected to some extent is in the area of communication skills. The other life functions of mobility, health, cognitive-intellectual abilities, and social-attitudinal functions are all affected to a greater or lesser degree. The degree of effect, however, may vary greatly depending upon the individual and the severity of the disease. While emphysema is not a reversible disease, its progress may be slowed or even halted with early diagnosis and proper treatment and therapy. Thus, some patients may live for years with the disease with the symptoms having been arrested at an early stage. Although these patients never regain the use of their destroyed lung tissue, they are able to cope with the mild effects of the disease. The more typical case, however, is diagnosed relatively late in the course of the disease, and the patient's life functions are more severely affected. Figures are unavailable as to the percentages of mild, moderate, and severe cases and the number of cases which are arrested compared to those which progress through the stages of the disease. The American Lung Association in a national health survey found that of the 1.3 million emphysema victims, 44.9% of these cases were severe enough to cause a limitation in activity. Although the definition of "limitation in activity" is unclear; this figure suggests the proportion of patients with moderate to severe cases. This discussion of the effects of the disease on the patient's life functions will describe symptoms common at each stage, but will focus primarily on the moderate and severe stages during which the patient's life functions are most severely affected.

Mobility. Table 3-2 describes the symptons which restrict the emphysema patient in the area of mobility. Dyspnea, or breathlessness, upon exertion and the fatigue associated with the simple process of inspiration and expiration of air are the primary symptoms of emphysema in the early stages. Dyspnea is usually the chief complaint which first brings the patient to the physician (Belinkoff, 1971). Fatigue then becomes the chief enemy of the patient. As emphysema in its early stages is a relatively "invisible" disease in which the patient shows no external signs of ill health, many patients go to great efforts to hide these symptoms, particularly in their employment situations (Hodgkin, et al., 1975). However,

TABLE 3-2

EMPHYSEMA: MOBILITY

Statement of Problem	Dynamics	Source
Dyspnea and fatigue upon exertion.	Begins even prior to diagnosis, progresses with severity of disease.	Belinkoff, 1971; National Tuberculosis and Respiratory Disease Association, 1972; Hodgkin, et al., 1975.
Difficulties in fine motor control.	Moderate to severe stage.	Emphysema-killer at large, 1973.
Restriction on air travel and at altitudes over 4,000 ft.	Severe stage.	National Tuberculosis and Respiratory Disease Association, 1972.

as the disease progresses mobility and eventually any form of exertion, becomes a severe problem. Table 3-3 describes a classification scheme devised for dyspnea. This scheme reflects the limitation on mobility as the disease progresses. One can see that while at the early stages relatively little restriction on mobility is necessary, by the latter stages of the disease virtually any movement is made with great effort.

Restrictions on air travel and driving are generally not necessary during the mild stage, but do come into effect at later stages. Eventually, the physical exertion required to drive a car simply becomes too much for the patient. Air travel is generally acceptable for most patients of pulmonary emphysema with the exception of those patients whose condition is serious enough that they become dyspneic when at rest at sea level. For any patient with severe pulmonary emphysema, altitudes above 4,000 feet present some problems (National Tuberculosis and Respiratory Disease Association, 1972).

Health: This area constitutes perhaps the most severely affected life function area for the pulmonary emphysemic patient. As mentioned previously, by the time the disease is diagnosed, the symptoms of dyspnea and fatigue are readily apparent to the patient. These symptoms, while subject to some improvement through therapy, will continue throughout the patient's life. In addition, various other health complications are likely to occur. Finally, the patient must learn to live with the fact that the disease itself or one of the complications frequently associated with the disease is likely to eventually result in his death. While many patients, particularly those with early diagnosis, may live with emphysema for years, the disease is, nevertheless, irreversible. Its progress may be greatly slowed, but destroyed lung tissue cannot be regenerated. Medication and

TABLE 3-3

CLASSIFICATION OF DYSPNEA

Grade I:	Can keep pace on walking on the level with a normal person of his age and body build, but not on hills or stairs.
Grade II:	Can walk a mile at his own pace without dyspnea, but cannot keep pace on the level with a normal person.
Grade III:	Becomes breathless after walking about 100 yards or for a few minutes on the level.
Grade IV:	Becomes breathless while dressing or talking.

From National Tuberculosis and Respiratory Disease Association, Chronic Obstructive Pulmonary Disease: A Manual for Physicans, 1972.

other forms of therapy will become a part of the patients daily routine.

Table 3-4 describes some of the common symptoms of pulmonary emphysema which effect the health functions of the patient and the precautions the patient must take to maintain his health functions.

As may be seen in the table, some of the more common precautions which the patient may be advised to take concern the individual's climatic environment, his smoking behavior, his exposure to respiratory infections, and his diet. The environmental or weather conditions have been found to have a definite effect upon the severity of the patient's symptoms (Farber and Wilson, 1968; National Tuberculosis and Respiratory Disease Association, 1972). Extreme hot or cold weather or abrupt changes in weather can aggravate sputum production and bronchial obstruction (Hodgkin, et al., 1975). Likewise, extremely dry air may stimulate lung irritation. Room humidifiers are often recommended for emphysemous patients to use in the home (National Tuberculosis and Respiratory Disease Association, 1972). In addition, air pollution in the environment may be an additional aggravating factor in the progress of the disease (Rodman and Sterling, 1969). In spite of the importance of the climate upon the disease, it has been found, however, that a majority of patients do not benefit from a change in climate (National Tuberculosis and Respiratory Disease Association, 1972). This may be due to detrimental psychological factors associated with moving which override the positive environmental effects. In any case, it is suggested by many authorities in the area, that if a change in climate seems advantageous, the patient should be advised to take a long preliminary visit to the prospective area first (National Tuberculosis Respiratory Disease Association, 1972; National Heart and Lung Institute, 1974; Rodman and Sterling, 1969).

The cessation of smoking is always a help in the control of the disease and is recommended as an immediate step in treatment. Patients themselves generally note an immediate improvement upon stopping as evidenced by reduced coughing and dyspnea (Belinkoff, 1971).

Respiratory infections are a major danger in patients with pulmonary emphysema as a minor infection may cause a serious relapse in the patient and leave him in a permanently worse condition (Hodgkin, et al., 1975). The sudden onset of hypoxia and hypercapnia precipitated by an acute respiratory infection is the second most common cause of death in pulmonary emphysema patients (Rodman and Sterling, 1969). Thus, protection from respiratory infections cannot be overemphasized. The patient should be immunized every year, should avoid crowds and people with colds, and should remain indoors during peak or epidemic periods.

The patient's diet is important from a dual standpoint. Obesity should be avoided at all costs due to the additional energy required for support. On the other hand patients in the later stages of the disease often tend to suffer from loss of appetite, or the act of eating may simply be too fatiguing for them, thus significant weight loss is a common sympton at this stage. The patient should be encouraged to eat small, high-protein meals avoiding gas-producing foods, carbonated beverages, greasy and fatty fried foods which may produce abdominal distention and shortness of breath (Belinkoff, 1971; Hodgkin, et al., 1975). A high fluid or water intake is also encouraged as water acts as an effective expectorant to liquidify sputum (Hodgkin, et al., 1975).

Complications associated with pulmonary emphysema are frequently as much of a problem to the patients as the symptoms of the disease itself. Table 3-4 lists some of the most common complications of the disease, and

TABLE 3-4

LIFE FUNCTION TABLE - EMPHYSEMA: HEALTH

Statement of Problem	Dynamics	Source
Dyspnea.	Prior to diagnosis and on.	Baum, 1974; National Tuberculosis and Respiratory Disease Association, 1973; Cumming and Semple, 1973.
Cough with sputum.	Prior to diagnosis and on	Cumming and Semple, 1973.
Fatigue, weakness.	Mild stages of disease; becomes worse as disease progresses.	Baum, 1974.
Weight loss: up to 20%.	Moderately severe and severe stages.	Rodman and Sterling, 1969.
Need for proper climatic environment.	Moderate-severe stages; can be aggravatic factor at mild stage.	Hodgkin, et al., 1975; Belinkoff, 1971.
Need to avoid smoking and other inhaled pollutants.	Upon diagnosis.	Hodgkin, et al., 1975; Petty, et al., 1974.
Need to avoid respiratory infections.	Upon diagnosis.	Belinkoff, 1971; Hodgkin, et al., 1975.
Need for controlled diet; maintain normal weight.	Upon diagnosis.	Belinkoff, 1971; Hodgkin, et al., 1975.

TABLE 3-4 CONT'D.

State of Problem	Dynamics	Source
Left ventricular heart dysfunction.	Moderate to severe cases.	Unger, Shaw, et. al., 1975; Rao, Cohn, et. al., 1968.
Cor. pulmonale with right ventricular failure enlarged right ventricle reflecting pulmonary.	Severe stage (most common cause of death; found in 40% of autopsies).	Rodman and Sterling, 1969; American Lung Association, 1975.
Peptic ulcer.	Mild to severe cases (found in 25% of emphysema cases).	Rodman and Sterling, 1969; American Lung Association, 1975; Belinkoff, 1971.
Pulmonary thromboembolism (blood clots in pulmonary arteries).	Advanced case.	National Tuberculosis and Respiratory Disease Association, 1972; Rodman and Sterling, 1969; American Lung Association, 1975.
Spontaneous preumothorax (lung collapse).	Advanced case.	National Tuberculosis and Respiratory Disease Association, 1972; Rodman and Sterling, 1969; American Lung Association, 1975.
Pulmonary arterial hypertension	Advanced case (found in 40% of post-mortem examination of emphysema patients).	National Tuberculosis and Respiratory Disease Association, 1972.
Lethal cardiac arrhythmia.	Advanced case (third most common cause of death in emphysema patients).	Rodman and Sterling, 1969.
Abnormal gas exchange accumulation of CO_2.	Advanced case (third most common cause of death in emphysema patients).	Rodman and Sterling, 1969.
Cirrhosis of liver.	Associated with homoygous alpha-antitrypsin serum deficiency.	Mittman, 1972.
Nausea and vomiting; gastrointestinal problems.	Caused by use of certain bronchodilator and expectorant.	Baum, 1974; Belinkoff, 1974.
Hypertension, insomnia.	Associated with use of bronchodilator ephedrine.	Baum, 1974.

in addition, complications occurring as a result of drugs used to treat the disease. These complications present severe threats to the emphysema patient's general health functions. The various types of heart dysfunction present the most serious threat to the life of the patient and are caused by the strain placed upon the heart in pumping blood as the patient begins to exhale carbon dioxide less efficiently. Peptic ulcers are a quite common condition in patients with pulmonary emphysema; however, the basis for the connection is unknown. It was for some time believed to be connected with the use of steroids in the treatment of emphysema; however, the incidence of peptic ulcers seems to be evenly distributed from mild to severe patients, indicating length of treatment is not an important factor (Rodman and Sterling, 1969). The exact cause of the relationship between the two diseases therefore remains unknown (American Lung Association, 1975).

Side affects from drugs used in the treatment of pulmonary emphysema is another more minor complication of the disease which affects the patient's health functions. The oral bronchodilator animophyline which is used for relaxation of the bronchial airways has been found to produce nausea and vomiting with repeated doses. The other most commonly used oral bronchodilator, ephedrine, may cause urinary retention, prostatism, insomnia, or the aggravation of angina and hypertension in some patients (Baum, 1974). An overdose of bronchiodilator drugs can cause cardiac and nervous overstimulation, while too much of the drug in a short period of time may constrict or intensify the bronchiospasm rather than relaxing it as is the intended purpose of the drug (Belinkoff, 1971). A method of inhaling bronchodilator drugs through a hand-held nebulizer has been developed and is used frequently; however, the patient must take care to use the spray precisely at the point of inspiration in order for the drug to have effect. Precipitation of the drug in the throat gives no relief, has an unpleasant taste, and encourages gastrointestinal upsets (Belinkoff, 1971).

Expectorants are the second means of pharmacological treatment of pulmonary emphysema as these drugs act to loosen mucus in the lung making it easier to expel. These drugs have fewer side effects than the bronchiodilators. However, potassium iodide, which is used frequently, is often found to cause an irritation of the stomach which is very uncomfortable (Belinkoff, 1971). The chronic use of iodides, in general, has been found to promote bronchial irritation in patients and, thus, should be avoided (Baum, 1974).

In the cognitive-intellectual domain of life functions, for the patient with pulmonary emphysema is concerned with a gradual slowing down of intellectual functions. While these symptoms are not extreme, a definite deterioration in some mental abilities is found in some patients. This condition occurs rather late in the course of the disease and is due to a deterioration in the blood gas exchange in the body and a subsequent accumulation of carbon dioxide in the blood (National Tuberculosis and Respiratory Disease Association, 1972; Rodman and Sterling, 1969). One investigation using the Hooper Visual Organization Test, the Benton Visual Retention Test, and the Wechsler Adult Intelligence Scale as measures of intellectual functioning found 88% of the subjects, all patients with Chronic Obstructive Pulmonary Disease, to have error scores suggesting difficulties in visual integration, visual memory, and fine motor control (Emphysema-killer at large, 1973). Other studies have suggested more general problems in learning new skills (Petty, et al., 1974). See table 3-6.

As one might assume with any serious illness, there are definite psychological side-effects as a result of diagnosis; however, the psychological damages from pulmonary emphysema appear to be more extreme than those of patients with similar disabling diseases. Rodman and Sterling (1969) state that "the long term management of a patient with Chronic Obstructive

TABLE 3-5

LIFE FUNCTION TABLE - EMPHYSEMA: COMMUNICATION

Statement of Problem	Dynamics	Source
Not applicable		

TABLE 3-6

LISTS THE DISABILITIES TO BE FOUND IN THIS AREA IN THE PATIENT WITH PULMONARY EMPHYSEMA

LIFE FUNCTIONS TABLE: COGNITIVE-INTELLECTUAL FUNCTIONS

Statement of Problem	Dynamics	Source
Gradual impairment of mental acuity, memory, and judgment, particularly visual integration, visual memory and fine motor control.	Severe stages.	National Tuberculosis and Respiratory Disease Association, 1972; Emphysema-killer at large, 1973; Petty, et al. 1974.
Problems learning skills.		Petty, et al., 1974.

TABLE 3-7

LIFE FUNCTION TABLE - EMPHYSEMA: SOCIAL-ATTITUDINAL

Statement of Problem	Dynamics	Source
Increasing irascibility, headache, insomnia.	Moderate-severe stage.	National Tuberculosis and Respiratory Disease Association, 1972.
Depression, anxiety, hypochondriasis.	From diagnosis on.	*Emphysema-killer at large*, 1973; Petty, *et al.*, 1974
Feelings of uselessness and rejection by society.	From diagnosis on.	Cumming and Semple, 1973; Rodman and Sterling, 1969.

Pulmonary Disease is often a difficult and demanding professional experience... The psychologic mechanism that is used by the patient as he gropes for an acceptable adjustment to his chronic disease is characterized by a reversion to the large dependency needs of childhood" (Rodman and Sterling, 1969).

The act of accepting the facts of diagnosis and the various aspects of treatment which must become part of the patient's daily life naturally create psychological problems. These problems are frequently complicated by concerns over societal expectations and one's ability to continue in one's present employment. As the symptoms of pulmonary emphysema are relatively invisible to others in the early stages, many patients feel reticent to cut back on activities at work for fear of criticism from other employees; many, in fact, overwork themselves at this stage (Hodgkin, et al., 1975). While the patient should continue working, if possible, during the early stages of the disease, he may need to take some precautions to avoid over-exertion.

In later stages of the disease, when the patient may be required to give up his job and physical activity becomes increasingly exhausting, feelings of depression, despair, and helplessness frequently occur (Cumming and Semple, 1973). The patient is most often a man in his fifties or sixties who has supported his family for years, and now sees himself as losing his role as provider and becoming a burden upon his family. Often at this stage, physical symptoms are still not readily apparent to the outside observer, and this makes the patient's inactivity more psychologically difficult to bear as he may feel societal pressure to maintain his former role.

Conversely, patients also frequently feel rejected by society due to the nature of their symptoms. Dyspnea, and the frequent expectoration necessary for the patient, are often viewed as socially unacceptable. Thus, the patient, particularly during the moderate and severe stages of the disease, often begins to avoid social situations and becomes somewhat reclusive and withdrawn (Cummings and Semple, 1973).

The emotional reactions of the patient are generally of a depressive and hypochondriacal nature frequently accompanied by regressive, dependent behaviors (Petty, et al., 1974; Rodman and Sterling, 1969). Results from an investigative study using the Minnesota Multiphasic Personality Inventory to measure psychological reactions to disease showed that a sample of 147 Chronic Obstructive Pulmonary Disease patients showed more depression, anxiety, and hypochondriasis than the general medical population (Emphysema-killer at large, 1973).

The psychological problems inherent in accepting a long-term disease are complicated by the physical aspects of the disease, most particularly the accumulation of carbon dioxide in the blood, which causes increased irascibility, frequent headaches and insomnia (National Tuberculosis and Respiratory Disease Association, 1972).

The extent of these psychological reactions leads many physicians and researchers to advise some type of psychological therapy in conjunction with the treatment of the physical aspects of the disease. Petty, et al. (1974) suggest that this therapy should be geared to the severity of the disease, but in any case should concentrate on improving the patient's self-image while avoiding emotional upset which might, in later stages, cause damage to the heart and lungs. They recommend behavior therapy as a means of modifying the detrimental aspect of the disease-related behavior while avoiding some of the emotion-laden, insight techniques of traditional psychotherapy. They go on to state that the patient might be allowed to retain some of his psychologically abnormal amounts of denial, repression, and social isolation in order to cope with the effects of the disease.

VI. Functioning as a Member of Society

The literature provides information about functioning in the work force and in the community by persons with emphysema.

Functioning as a Member of the Labor Force

As discussed previously, pulmonary emphysema is the third leading cause of disability reported to the Social Security Administration and costs more than $400 million a year in disability benefits (American Lung Association, 1975). Pulmonary emphysema tends to strike white males in their fifties and sixties, many of whom are the primary breadwinners for their family. The disease frequently requires the patient to restrict his occupational activities or, in the later stages, to stop work completely. Physicians are cautioned to consider carefully before recommending retirement or a change in work due to the psychological side-effects this might have (National Tuberculosis and Respiratory Disease Association, 1972). In addition, the patient needs to be reasonably active, doing as much as he physically can, short of exhaustion (National Heart and Lung Institute, 1974). Care should be taken not make the patient into a invalid prematurely by oversolicitous restrictions. Nevertheless, in many cases restrictions in occupational activities do eventually have to be made. While those employed in white-collar, or relatively sedentary, positions can often carry on adequately in their jobs for some years, the laborer to skilled worker faces more problems due to the nature of his job, particularly the physical exertion and manual dexterity required, and is more frequently faced with early retirement. The white-collar worker may also be faced with problems as his mental acuity gradually slows due to the buildup of carbon dioxide. Thus, while the patient may continue as a member of the work force for some time, depending upon the nature of his occupation, adjustment and adaptation are required, and, even, then, restriction or early retirement is frequently necessary. The earlier figures concerning Social Security disability benefits to patients with pulmonary emphysema adequately demonstrate the extent of this problem.

Functioning as a Member of the Community

As a family member, the patient often creates quite a strain. The patient is frequently the principle wage earner in the family, and if he is forced to quit work, this presents a definite financial strain. In addition, the rehabilitative treatment of the patient, and the possible restriction of his activities, have an effect on the everyday life of the family members. Most discussions of rehabilitation and treatment stress the importance of including the family as an integral part of the rehabilitation process (Petty, et al., 1974). Rehabilitation involves a whole new way of life with the therapeutic procedures--drugs, exercises, etc.--becoming a part of the patient's daily routine. This process can be aided greatly by the family's active cooperation. This requires much effort and understanding on the part of family members who must make sure that the patient does not over-exert himself while at the same time encouraging him to be as active as possible. The family's role is further complicated by the emotional attitude of the patient. The psychological side-effects of pulmonary emphysema including depression, despair, and hypochondriasis exacerbate the patient's interactions with the family. All these factors act to change the patient's role in the family.

The patient's functioning in the outside community is less affected during the mild stages of the disease. However, as the disease progresses the symptoms of dyspnea and the frequency of expectoration often cause the patient to withdraw socially for fear of ostracism. His psychological problems further complicate his functioning in the community, primarily by diminishing his desire for social activity. The symptoms are discussed more fully in the section dealing with the social-attitudinal life functions associated with pulmonary emphysema.

VII. Technologies -

1. Patient and family education concerning disease and treatment (Petty, 1974).
2. Bronchodilator drugs - provides for maximum relaxation of airways, mucosal decongestion, and stimulation of mucociliary clearance. May have side effects of gastrointestinal problems, nausea, hypertension.
3. Expectorants - used to liquefy secretions in the bronchii and facilitate their removal. Iodides used for this purpose may cause bronchial irritation. (HEW, n.d.; Baum, 1974; Belinkoff, 1971).
4. Breathing retraining and pursed lip breathing - slowed breathing and abdominal diaphragmatic breathing with exhalation against pursed lips (Mueller, Petty, and Filley, 1970; Baum, 1974; Petty, 1974).
5. Postural drainage exercises - one of most effective therapies when used in conjunction with clinical measures (HEW, n.d.).
6. Daily periods of treadmill walking - (Woolf and Suero, 1969) or light exercise (Petty, et al., 1974).
7. Ambulatory Oxygen therapy - (Petty, 1974).
8. Antibiotics and immunization to present respiratory infection (HEW, n.d.; Baum, 1974; Belinkoff, 1971).
9. Behavior modification therapy and other treatments for psychological problems (Petty, et al., 1974).
10. Restriction of activities (Belinkoff, 1971; Rodman and Sterling, 1969).
11. Relocation and environment (National Tuberculosis and Respiratory Disease Association, 1972; Hodgkin, et al., 1975).
12. Comprehensive, interdisciplinary treatment teams - (Hodgkin, et. al., 1975; Fishman and Petty, 1971; Petty, et al., 1970; Petty, et al., 1974).

VIII. Service Delivery

There are several private and public organizations which are involved in research and education of the public concerning emphysema and treatment and rehabilitation of patients. The primary organizations active in this area include:

American Lung Association

National Heart and Lung Institute, a branch of Health, Education, and Welfare Department of the United States Government.

National Tuberculosis and Respiratory Disease Association.

The current approach to the treatment and rehabilitation of patients with pulmonary emphysema focuses on an inter-disciplinary, comprehensive approach which deals with all the different areas of the patient's life which are affected by the disease, i.e., social and psychological, as well as physical (Hodgkin, et al., 1974; Emphysema-killer at large, 1973; Petty, et al., 1974; HEW, no date). Patient education and his own involvement in the rehabiliation process is seen as most important (Petty, 1974). In this sense, the treatment of the disease is viewed as similar to that used with diabetes in that the patient must be taught the importance of living with and adapting his life to his disease (Baum, 1974).

The Report of the Task Force on Comprehensive and Continuing Care for Patients with Chronic Obstructive Pulmonary Disease, by the American Lung Association outlines what is meant by a comprehensive, inter-disciplinary approach to treatment. Personnel involved in treatment might include physicians, professional nurse, therapists (occupational, recreational, physical, respiratory), psychosocial personnel (medical social worker, psychiatric social worker, case worker), and technicians (X-ray, laboratory, respiratory, home health aid). The task force goes on to make recommendations concerning the implementation and operation of such teams.

Another report by the Inter-Society Commission for Heart Disease Resources concerns the community resources for rehabilitation of patients with chronic obstructive pulmonary diseases and pulmonale. It also makes recommendations for comprehensive, inter-disciplinary teams for treatment. In addition, the authors describe in detail the operations of three different respiratory care service programs which have been implemented in different areas of the country. All use some type of multidisciplinary approach and are geared to a greater or lesser degree to serve patients at the different stages of disease.

Respiratory care centers are being established to deal with the long-term handicaps of this disease. Due to the many different areas of life function which the disease affects, it appears that this new multidisciplinary approach is the most adequate to deal with the diverse needs of the pulmonary emphysemic patient.

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CHAPTER 4
DISABILITY ANALYSIS: CARCINOMA OF THE COLON/RECTUM

1. Definition

In order to discuss cancer of the colon/rectum, it is necessary to define and clarify the term cancer. Cancer refers to a group of diseases rather than one specific disease. There are, however, certain common characteristics shared by all forms of cancer. These include: (1) a higher rate of cell growth than the normal tissues from which cancers are derived, (2) failure to maintain the boundaries of normal tissues and organs, (3) a microscopic appearance which suggests in some ways a resemblance to immature rather than mature tissues, and (4) a tendency to spread to parts of the body distant from the original site of the cancer (Levin, Devesa, Godwin & Silverman, 1974).

Despite cancer diseases having certain biological features in common, most observers are more impressed by the great differences among various forms of cancer. These differences are due, in large part, to the variety of cell structures from which tumors can develop--muscle, glands, blood and lymphatic vessels. Any one of these different cell forms may give rise to varying forms of cancer. Table 4-1 lists forms of cancer based upon histologic types (structural origin).

This study will be concerned with one specific cancer form--carcinoma of the colon/rectum. Cancers at these sites are considered to be carcinomas, as 95% of the malignant tumors are epithelial in origin and these 95% are classified adenocarcinomas (dePeyster and Gilchrist, 1969). Adenocarcinomas

TABLE 4-1

FORMS OF CANCER BASED ON HISTOLOGIC TYPE

Histologic Type	Definition
I. Sarcomas	Cancers arising from the connective tissue (including bones).
II. Lymphoma; Leukemia	Cancers of the blood-forming system (related to sarcomas).
III. Carcinomas	Cancers arising from cells which line the body's internal and external surfaces.
A. Adenocarcinomas	Form of carcinoma arising from glandular structures.
B. Squamous Cell	Form of carcinoma arising from skin and other non-glandular surfaces.

(Source: Levin, et al, 1974)

occur throughout the colon and rectum, with the highest incidence in the distal sigmoid colon and rectum. In the colon there are four major cancer subsites: acending colon, transverse colon, descending colon, and the sigmoid colon . Most cancers occur in the sigmoid (41%) and secondly in the ascending colon (34%) (End Results, 1968). Due to the position of these carcinomas, most can only be cured by surgical means (87%) (Southwick and Cole, 1969).

II. Societal Characteristics of Persons with Colon/Rectum Cancer

The literature provides incidence and prevalence information about persons with colon/rectum cancer.

Incidence and Prevalence

Cancer in any form is a potential killer. One in every four persons in the United States will develop some form of cancer during the course of their lives, while only 1 in every 3 patients will be saved (President's Commission on Heart Disease, Cancer and Stroke, 1964). With the improvements in diagnosis and treatment--chemotherapy, radiation, therapy, new surgical techniques--certain cancers are at least being controlled and arrested in early stages of development. Unfortunately, this is not true of cancer of the colon/rectum, as well as many other cancers of the digestive system. Cancer of the colon/rectum has the dubious distinction of being the second most common cause of cancer deaths throughout the country (Southwick and Cole, 1969).

Incidence rates do not vary widely, as most researchers utilize the data collected by the National Cancer Institute Surveys. Generally, figures are combined into a colon/rectum category and differentiated by sex, and due to the fact that rectal carcinoma is more common in men and carcinoma of the colon is more common in females (End Results, 1968). The resulting incidence figures are:

45.2 per 100,000 for males,

49.0 per 100,000 for females.

Although this form of cancer strikes more females than males, the survival rates for women are consistently higher than men regardless of the subsite or state of the disease.

The prevalence rate of any disability is quite difficult to measure, and cancer of the colon/rectum is no exception. However, one method of computation of prevalence rates is partially successful, namely the combination of data on annual incidence and survival rates. This method gives the number of people now alive who ever had cancer and includes both prevalent cases and persons cured of cancer. Table 4-2 indicates the estimated number of persons in the population who are alive with a history of cancer, computed for the year 1971.

While cancer of the breast is the most prevalent form of cancer, it only affects the female population. If one wants to take into account the portion of the population, colon/rectum cancer becomes the most prevalent. In this study, therefore, we are dealing with a significant portion of the cancer population.

Cancer of the colon/rectum accounts for 57.8% of all forms of digestive cancer (see Table 4-3).

The American Cancer Society estimated that in 1968 alone there would be 73,000 new cases and 45,000 deaths due to cancer of the colon/rectum.

Mortality. According to Harlnett (1953), the average life expectancy of patients with untreated colon cancer is 8.4 to 8.7 months from the onset of symptoms. The life expectancy of patients with untreated rectal cancer is 14.3 to 19.6 months. Furthermore, the average duration of time

TABLE 4 -2

PEOPLE ALIVE WITH CANCER

Cancer Type	Number of People
Breast	677,000
Colon/Rectum	495,000
Total Uterus	387,000
Prostate	201,000
Lung & Bronchus	85,000
Lymphomas	45,000
Stomach	39,000
Pancreas	37,000
Esophagus	5,000
All sites	4,000

(Information from Levin, et al., 1974).

TABLE 4 -3

CANCER FOUND IN DIGESTIVE SYSTEM

Cancer Site	Per Cent of Digestive System Cancer Found at This Site
Colon	35.0
Rectum	22.8
Stomach	19.0
Pancreas	10.0
Esophagus	7.0
Gall bladder & ducts	4.5
Liver	1.7

(Information from End Result, 1968).

from onset of symptoms to treatment is 5.3 months. Unfortunately, this short time period is of critical importance, as 40% of the colon/rectum patients are incurable at the time of treatment (usually surgery) (dePeyster and Gilchrist, 1969). Therefore, one is dealing with a disability in which death soon after diagnosis is a distinct probability.

Of these who remain alive, the median survival rate varies by the patient's age. Adjusting for normal mortality expectations, the 5-year rate of survival for patients under 45 years of age is 59%; it then decreases rapidly from 51% for patients 45-54 years old to 37% for patients 75 years and older. The chances of one's survival vary according to the location of the carcinoma (subsite), the extent of the spread of cancer (localized or regionalized) and the age of the patient (younger patients are generally healthier) (End Results, 1968).

III. Demographics

Age. Cancer, for the most part, is a disease affecting older people. Carcinoma of the colon/rectum is no exception. Eighty percent of the patients with colonic cancer are 55 years of age and older, while 58% of all rectal cancer patients are over 65 years of age.

Ethnicity. According to Levin, *et al.*, (1974) whites have a higher incidence of colon/rectum cancer (44.3%) than for blacks (43.2%), though they are not significantly different.

Urban/Rural. Colon/rectum cancer occurs with greater frequency in economically developed areas. Rates of large bowel cancer are higher in the urban rather than the rural areas, with the greatest number of cases being reported in the Northeast and the Northcentral states. This is believed due to the low fiber, highly refined carbohydrate content of the diets found in these areas. Diets of this type aid the development of carcinogens in the colon and rectum (Burdette, 1971).

IV. Etiology

At this point in time there is no general consensus on the causes of carcinoma of the colon/rectum. It is believed by some researchers that certain hereditary factors can result in cancer of the colon/rectum later in life. These include certain familial diseases (globulin deficiencies, Gardner's syndrome, familial polyposes) and other predisposing conditions (ulcerative colitis, villous adenoma, Crohn's disease). There is also an increased risk (two to three times the normal) to those people with immediate family members having colon/rectum cancer (Burdette, 1970).

It is believed by Burdette, (1971), as well as a number of other experts, that environmental factors probably are more important than hereditary factors--the number one environmental factor being diet. Low fiber, highly refined carbohydrate diets (those found in urban areas) reduce the speed of "food" transit through the bowels. As a result of this, carcinogens formed by metabolized food are held in prolonged contact with organic tissue, thus increasing the chance of carcinoma of the colon/rectum. Such an hypothesis is given further validity by the fact that populations from areas of low rates of colon/rectum cancer upon migration to areas with high rates of cancer of the colon/rectum acquire incidence rates similar to those of their newly adopted country (Levin, et al., 1974).

V. Life Functions

In terms of the five life functions to be utilized in this study, only two are significantly impaired by carcinoma of the colon/rectum--health and social-attitudinal. The rapid, uncontrollable growth of cells in the colon/rectum area does not affect one's mobility, communication or cognitive-intellectual life functions.

Treatment is largely surgical in nature resulting in colostomies for colon/rectum patients. Diagnosis of this disease often is not made until it has spread to the lymphatics and has become regionalized rather than localized. This results in an increased amount of tissue which must be removed, as well as a greater chance of cancer's spread to other areas the body. Merely increasing the amount of tissue removed at the time of the operation no longer appears to be the answer, as removal of additional anatomic structures significantly increases morbidity and mortality without any realistic chance of improving the results (Rosi, 1969).

Health

This life function must be further divided into two subcategories, the first being the health of the cancer victim before treatment, the second being the health of a cancer patient after treatment. In the former area, patients with carcinoma of the colon/rectum exhibit the following manifestations:

1. Weight loss--a majority of patients have some loss of weight with the onset of symptoms. This weight loss usually is maintained until treatment. (Usually 10 pounds or less).

2. Anemia--four to twenty percent of patients having colon/rectum cancer have a significant degree of anemia.

3. Pain--similar to colic or cramplike pain, though it may result in peritonitis.

4. Blood in Stool--ninety percent of colon/rectum patients have "red" blood appearing in their stool. This is regarded as an important danger

signal of colon/rectum cancer.

Table 4-4 discusses these symptoms further.

There are significant problems even for those individuals successfully treated for cancer of the colon/rectum. Surgery consists of removing malignant tissue from the colon and rectum. The amount of tissue excised depends upon the extent to which the cancer has spread. Invariably, the cancer has spread so as to necessitate a colostomy. A colostomy involves the formation of a new anus, by bringing an end of the large intestine through the abdominal wall to serve as the organ of defecation. The new opening called a stoma is covered by a 4 x 4 inch gauze pad, a colostomy cup, or a plastic bag depending upon the type of colostomy performed (i.e., whether on the right side, the left side, etc.), and requires the patient to use special irrigation techniques to cleanse the bowels. This type of cure, although usually ridding the patient of cancer creates its own health problems:

Impotency--A study conducted by Stahlgren and Ferguson, (1958) found 48% of the male colostomy patients to be impotent. This in part is a physiological problem, as this type of surgery can cause damage to certain pelvic innervations. Druss' study (1969) found only 45% of those colostomy patients interviewed were having sexual relations; while 21% of the females lacked any sensation other than pain during intercourse.

Odor--According to Druss (1969), 44% of those interviewed were concerned with unpleasant odor, while 58% changed their diets to help manage discharge of gas and fecal material. A number of researchers found fear of odor keep patients from socializing with others.

TABLE 4 -4

COMMON MANIFESTATIONS OF COLORECTAL CANCER WITH PERCENTAGE OF OCCURRENCE*

	Sources			
	Cattel, et al 148 cases	Hallstrand 252 cases	Palumbo, et al 80 cases	dePeyster, Gilchrist 100 cases
Change in bowel habits	69.3		72.55	50
Pain	68	69.96	81.25	24
Blood in stool (gross)	66	66.40	48.75	47
Anemia	20.6	4.35		12
Palpable mass (abdominal)	13.3	25	35.2	10
Weight loss	50.6	76.28	66.25	6+
Obstruction		10.27	25.00	10
Asymptomatic				7

* dePeyster & Gilchrist, 1969

+ Weight loss exceeding 10 lbs. within 6 months before treatment

Exhaustion--Feelings of exhaustion, weakness and fragility were quite common during the first year after a colostomy.

Management Problems--During the first year after the operation the problems of learning correct and efficient irrigation techniques became of foremost importance. A great deal of anxiety and insecurity is derived from the inability to properly irrigate the colostomy. There are also other management problems such as discharge of gas and fecal material, as well as pain around and within the colostomy.

Work--Due to the need to irrigate the colostomy 19% of the males interviewed changed their work habit by going to the office late or reducing their work hours (Druss, 1969).

Table 4-5 lists the problems the cancer patients often experiences in the health life function. While the physiological problems are great, they are not insurmountable by modern technology. In fact, Druss (1969) reported on a follow-up study of cancer patients, the great majority of whom felt they were in good physical health a year after surgery. Eighty-nine percent reported they were experiencing good to excellent health, and only 11% reported poor health. Apparently, psychological rather than physiological factors keep many patients incapacitated.

TABLE 4 -5

LIFE FUNCTION TABLE - CANCER: HEALTH

Statement of Problem	Dynamics	Source
Shortened life expectancy	2.2 years - median life expectancy rate; only 46% of colon cancer patients and 40% of colon cancer patients survive 5 years or more.	Levin (1974); END RESULT, 1971
Early retirement	for 90% of patients with colon/rectum cancer.	Crawford, 1971
Susceptibility to false or exaggerated claims for the cure of cancer.	from the onset of the disease.	Grant, Bartlett, 1974
Uncontrolled bowel movement and/or change in bowel habits.	until the patient can correctly manage colostomy.	Lenneberg, 1971; Cattel, et al., Palumbo, et al., dePeyster & Gilchrist, 1969.
Odor	Due to discharge of gas and fecal material	Fried, 1975; Lenneberg, 1971.
Familial diseases which can be associated with colon/ rectum cancer: globulin deficiencies Gardner's syndrome familial polyposes ulcerative colitis villous adenoma Crohn's disease	All are possible predisposing conditions of colon/rectum cancer.	Burdette, 1970
Pain- similar to colic or cramplike pain	Suffered by over 50% of colon/rectum cancer patients	Cattel, et al., 1955, dePeyster & Gilchrist (1969), Hallstrand, 1954, Palumbo, et al., 1923.
Blood in stool	90% of colon/rectum patients had "red" blood appearing in their stool	-"-
Anemia	4-25% of colon/rectum patients have a significant degree of anemia.	-"-
Weight loss	A majority of patients lose weight with the onset of symptoms.	-"-

TABLE 4-5 CONT'D.

Statement of Problem	Dynamics	Source
Disease incurable (causes death)	40% of colon/rectum patients are incurable at the time of treatment.	dePeyster & Gilchrist, 1969
Exhaustion, weakness and fragility.	Quite common during the first year after colostomy	
Discharge of gas and fecal material	Until patient learns proper management techniques.	
Pain around and within the colostomy.	During the first year after surgery.	
Problems in learning correct and efficient irrigation techniques.	A major problem immediately after a colostomy	
Prolapse (slipping out of place of an internal organ).	Unless stoma is properly affixed.	Lenneberg (1971)
Incomplete emptying of bowels.	Until stoma management is learned (all patients).	-"-
Parastomal abscess	Until fault is corrected	-"-
Obstruction with the intestine	Until corrected (all patients)	-"-
Obesity	Until proper diet and exercise is maintained.	-"-
Protracted waiting period for anastomosis	Until the severed ends of intestines are joined (all patients).	Lenneberg, Edith (1971), Proceedings of the Annual Conference on Cancer, Univ. of Texas, M-D Anderson Hospital and Tumor Institute.
Skin breakdown	Pending correct placement of the stoma, or proper rectecal (most patients)	Lenneberg (1971)
Impotence (male) - can be physiological problem	48% of the male colostomy patients were found to be impotent.	Stahlgren & Ferguson, 1958; Sutherland Aathon (1952); Psychosocial Aspects of Cancer, Public Health Reports 1952, Baird et al., Colostomy Problems; the patient's recipient: Journal Kansas Medical Society 1967.

TABLE 4-5 CONT'D.

Statement of Problem	Dynamics	Source
Female intercourse	21% of female colostomy patients lacked any sensation other than pain during intercourse.	Druss, 1969
Paracolostomy hernia	Until management is obtained	Lenneberg (1971)

Social Attitudinal

According to Orbach and Tallenl (1957), colostomy patients exhibit great anxiet over the loss of anal control; and often irrigation rituals including prayers and repetitive acts are instituted to compensate for their loss (Sutherland, 1952).

Depression is another common occurrence. Druss (1969) found 56% of those interviewed had initial post-operative depression with approximately 20% becoming suicidal. A common reaction was: "What will people think when they find out about my colostomy?" Other investigators reported patients having feelings of inadequacy, anxiety, shame, degradation, and mutilation (Parsons, 1970; Baird, 1967; Sutherland, 1952).

In most cases, colostomy patients experienced a definite deterioration in social relationships. (A decrease of 72% was reported by Druss, 1969). This was due to the patients withdrawal from society rather than other "normal" individuals shunning them. One of the reasons for this withdrawal was a fear of producing odor from the colostomy. The cancer patients also hesitated leaving home or taking trips for fear they would have problems with fecal matter. Basically, they questioned their adequacy within the social world, both socially and sexually (Parsons, 1970). Lenneberg (1971) reports colostomy patients had:

1. psychological problems in dealing with sexual relationships,
2. withdrew from family and friends,
3. retired from the work force earlier than necessary,
4. experienced periods of depression and anxiety.

It has been found that nurses and doctors and most especially spouses are the key to the patient's eventual success or failure in a satisfactory life adjustment (Dyk and Sutherland, 1956). Those spouses who can accept the colostomy and allow the patient to perceive himself/herself as a whole and healthy human being greatly enhance the patient's physiological and more importantly, psychological recovery.

TABLE 4 -6

SOCIAL - ATTITUDINAL

Statement of Problem	Dynamics	Source
Feelings of being mutilated, due to surgery	Usually for 1 - 2 years after the colostomy	Fried, 1975 ; Parsons, 1970; Baird, 1967; Sutherland, 1952.
Withdrawal from society and family; resentment toward healthy uninformed community members.	From diagnosis until acceptance of their disease; for some patients not until death.	Baird, 1967; Crawford, 1971; Druss, 1969.
Feelings of fear, anger and rage.	From diagnosis until some sort of acceptance of their disease; for some patients not until death.	Sutherland, 1952; Druss, 1969.
Need for cancer counseling for patient and family by a professional health team (physician, physical therapist, vocational counselor, etc.)	During all stages of diagnosis, treatment and therapy.	O'Neill, 1975; Wallen, Willard, Ruben, 1951.
Fear of odor keeps colostomy patients from socializing with others.	44% interviewed concerned with possible odors.	Druss, 1969
Irrigation rituals including prayers and repetitive acts compensate for loss.	Colostomy patients	Sutherland, 1952
Depression	56% of colostomy patients exhibited initial post-operative depression.	Druss, 1969
Suicidal	20% of colostomy patients exhibited suicidal tendencies.	Druss, 1969
Anxiety over loss of anal control.	Colostomy patients	Orbach, 1967

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CHAPTER 5
DISABILITY ANALYSIS: KIDNEY DISEASE

I. Definition

It would be more appropriate to discuss kidney diseases rather than kidney disease, as there is no specific identifiable entity as kidney disease. According to Know (1974), more than fifty debilitating kidney conditions exist, each affecting various parts of the organ and being the result of numerous etiological factors.

Due to the large number of kidney conditions, it has been necessary to devise a classification system. Table 5-1 presents one method of classifying the majority of diseases of the kidneys.

It is beyond the scope of this paper to define all of the kidney disease states noted in Table 5-1. However definitions of the more common forms will be provided within this section of the report. It should be noted that the category heading "Secondary to other disease outside urinary tract" lists essentially etiological factors which precipitate various diseases of the kidney. A discussion of diseases within this grouping will be found within the etiological section.

Definitions of the More Common Forms of Kidney Disease

Infectious Diseases of the Kidney. According to the ICD code, this category includes infection of the kidney and the renal pelvis (pylitis, pyelonephritis, pyelonephrosis), infection of the renal pelvis which involves the bladder (pyonephrosis), and infection of the tissues surrounding the kidney (perinephritis).

Pyelonephritis, the most common form of renal disease, is an infectious inflammation of the kidney tissue. At onset it may not interfere with kidney functioning but if untreated may lead to gross dysfunctions of the kidney. The National Kidney Foundation states that inadequate treatment of

TABLE 5-1

CLASSIFICATIONS OF KIDNEY DISEASE

- I. Infectious Diseases of the Kidneys
    - A. Pyelonephritis (including cases of "pyelitis")
    - B. Focal embolic pyelonephritis (due to septicemia)
    - C. Abscess within kidney; perinephric abscess
    - D. Tuberculosis of kidney

- II. Non-infectious Diseases of the Kidneys
    - A. Primary, within the kidney
        - 1. glomerulonephritis, acute or chronic
        - 2. nephrotic syndrome, nehprosis
        - 3. nephritis acute interstitial chronic (hereditary)
        - 4. tumors
            - a. benign
            - c. malignant
        - 5. cogential malformations
            - a. polycystic disease
            - b. congential absence of one kidney
            - c. specific disorders of tubules
                - 1. fanconi syndrome
                - 2. gystinosis
                - 3. renal tubular acidosis
    - B. Secondary to other disease of urinary tract
        - 1. renal stones (nephrolithiasis)
        - 2. obstructive disorders (uropathies) leading to hydronephrosis
            - a. enlargement of prostate
            - b. congential or acquired stricture
        - 3. renal artery or vein constriction
    - C. Secondary to other disease outside urinary tract
        - 1. diseases of blood vessels (vascular diseases)
            - a. malignant hypertension
            - b. arteriosclerosis (nehprosclerosis)
            - c. lupus erythematosus and collagen diseases
        - 2. metabloic diseases
            - a. diabetes mellitus
            - b. parathyroid disease
            - c. amyloidosis
        - 3. acute renal failure due to severe injury or shock
        - 4. toxic effects on kidneys
            - a. mercury, carbon tetrachloride and other poisons
        - 5. blood disorders
            - a. sickle cell anemia
            - b. purpura

Source: National Kidney Foundation, "Your Kidneys. Master Chemists of the Body," National Kidney Foundation, p. 22.

pyelonephritis may lead to cessation of the warning symptoms but the destructive process will continue and lead to chronic pyelonephritis followed by renal failure and death (U.S. Department of HEW, 1967).

In its acute form, pyelonephritis has all the characteristics of an infection such as chills, fever, nausea, vomiting, weakness and headache. It is almost always associated with the presence of pathogenic microorganisms in the urine or kidney or both, causing frequent and painful urination. The infected urine contains a large number of white blood cells, varying numbers of red blood cells, and small to moderate amounts of protein and bacteria. Acute infections may be confined to the bladder (cystitis) but the majority involve ureter and kidney as well, especially grambacelli (those in the bowel). Acute pyelonephritis attacks may be repeated, particularly when there is interference in urine drainage by stones, tumors, an enlarged prostrate, or by the physiological loss of tone which often affects the uterus in pregnancy (Williams, 1973).

Chronic pyelonephritis is remarkably free of symptoms except when infection flares up and temporarily becomes acute. Because of the lack of symptoms, it is frequently undiagnosed in life but is a common finding in routine autopsies. When the disease if far advanced with attendant hypertension and azotemia, there is no means of distinguishing chronic pyelonephritis from glomerulonephritis and nephroscerosis (U.S. Department of HEW, 1967, 1973; Pitts, 1974).

Non-Infectious Diseases of the Kidney

Glomerulonephritis. The principal glomerulopathies are as follows: acute, subacute, chronic, hereditary, and focal.

Glomerulonephritis ranks second only to pyelonephritis as a cause of extensive renal pathology. It may exist as an acute, self-limited disease characterized by complete and spontaneous healing; or it may be associated with progressive nephron destruction leading ultimately to renal failure and death from uremia (Bricker & Slatopolsy, 1965).

Acute glomerulonephritis is a non-infectious inflammation which involves the glomeruli throughout both kidneys. At onset, there may be a marked decrease in the rate at which fluid is separated from the blood at the glomerulus, however normal functioning is usually restored within a few days or weeks (National Kidney Foundation, undated).

Chronic glomerulonephritis is frequently asymptomatic for many years, and its presence is established only by medical examination. There is damage, slow buy progressive, to the glomeruli and the inevitable result is uremia (National Kidney Foundation, undated).

Nephrosis and the Nephrotic Syndrome. According to Dorland, "Nephrosis is any disease of the kidney characterized by purely degenerative lesions of the renal tubules (epithelium) and marked by edema (noninflammatory), albuminuria and decreased serum albumin (hypoalbuminemia)," symptoms which together with hyperlipemia, or increased serum lipids, constitute the nephrotic syndrome. Another definition of nephrotic syndrome is "a collection of signs and symptoms; a clinical entity due to multiple causes, intimately associated with many disparate diseases, directly due to increased permeability of the glomerular capillary wall resulting in massive proteinuria." More specifically, the nephrotic syndrome is characterized by edema, massive proteinuria, high levels of fatty substances in the serum and low serum albumin levels. According to the National Kidney Foundation (undated) this type of kidney disease is non-inflammatory, involves the glomerular membrane and results in the loss of large amounts of protein molecules in the blood which pass into the urine. The loss of protein into the urine results in the accumulation of large quantities of water in the body and edema or generalized swelling, the hallmark of nephrotic syndrome, follows.

The nephrotic syndrome manifests a variety of forms, with one of the most common being lipoid nephrosis. This form is particularly prevalent among children, with about 50% of the children who develop these symptoms also developing a spontaneous remission (U.S. Department of HEW, 1967).

Some clinicians and pathologists regard this syndrome as a form of glomerulonephritis, due to occurence of a variety of pathological conditions involving the glomeruli; others believe it to be an entirely separate entity (Brod, 1973). In general, much needless confusion exists about the syndrome among researchers and clinicians, caused in part by the dearth of information about its etiology and compounded by too rigid a classification system (Blainey, 1972).

Nephritis is described by Dorland's Medical Dictionary as: "A diffuse progressive or proliferative lesion affecting the varying proportion the renal parenchuma, the interstitial tissue, and the renal vascular system." (p. 988) There are essentially three forms of nephritis: acute, chronic and interstitial.

Acute nephritis can be divided into four groups:

1. Post-streptococcal acute glomerulonephritis, which can be further divided into first attack and exacerbation in chronic glomerulonephritis.
2. Benign acute hemorrahagic nephritis, possibly of viral origin.
3. Acute focal glomerulitis.
4. Acute nephritis associated with other diseases. (Jennings & Earle, 1968)

Interstitial nephritis implies inflammatory involvement of the supporting intertublar connective tissues in the absence of primary glomerular damage (Williams, 1973).

The initial symptoms of hereditary chronic nephritis may be only a mild weakness but later the symptoms progress to easy fatigibility, lassitude, weight loss, pallor, tetany and the complex electrolyte abnormalities of ruemia (Perkoff, 1971). Other associated clinical features are ocular abnormalities such as congenital cataracts, congenital nystagmus, myopia, sperophakia, anterior lenticus, etc. (Perkoff, 1971). Other associated clinical features are ocular abnormalities such as congenital cataracts, congenital nystagmus, myopia, sperophakia, anterior lenticus, etc. (Perkoff, 1971). In cases of hereditary nephritis where both glomerulonephritis and pyelonephritis are present, nerve deafness may be found in association with both the pyelonephritis and the nephritic pattern of this renal disorder (Black, 1972).

Tumors. Four major types of renal carcinomas are listed in the literature:

1. Papillary adenocarcinomas, apparently secondary to benign adenomas.
2. Transitional papillomas of the renal pelvis.
3. Renal embryoblastomas or Wilm's tumors, usually occurring in infancy.
4. Renal adenocarcinomas or hypernephroid cancers occurring in adults.

The last two are the most common forms of kidney tumors.

Wilm's tumor is considered by most authorities to be congenital and to arise from embryonal cells trapped in the kidneys. It is one of the principal malignancies in young children and in about 6% of the cases is clinically present at birth. If the tumor is large at birth it may cause abnormal labor and/or childbirth (dystoica) (Smith, 1972).

Pathologically, the tumor is thought to be secondary to increased renin production, reversible by complete removal of the neoplasm (Peters, 1975). In some instances Wilm's tumor is symptomless and is present purely as a space-occupying mass. It occasionally causes hematuria, and spreads freely, making the prognosis very poor (Williams, 1973).

Types of renal carcinoma encountered clinically in adults are usually either renal cell carcinoma occurs still more rarely. Rhabdoyosarcoma does occur, but the incidence of the sarcomas of the kidney are less than that of the carcinomas. Other forms of neoplasm--hemangeopericytoma, osteogenic sarcoma and levomyosarcoma--have also been reported (Peters, 1975).

Congenital Malformations. Congenital abnormalities in any other body organ (Smith, 1972; Blainey, 1972). Papper (1971) classifies malformations of the kidneys into the following groups:

1. Anomalies of number (solitary, supernumerary)
2. Anomalies of volume (hypoplasia, hypertrophy, supplementary lobe)
3. Anomalie of differentiation (renal dysplasia)
4. Anomalies of location (simple, unilateral or bilateral, ectopia, crossed ectopia with or without fusion)
5. Anomalies of median line fusion (horseshoe, L-shaped, cake, sigmoid kidney)
6. Anomalies of rotation
7. Anomalies of vessels
8. Anomalies of pelvis and ureter
9. Renal cysts.

Most (numbers 1 through 8) of the above classifications are defined by etiological criteria. Therefore a more detailed explanation of these will be found within the etiology section.

Renal cysts. (#9 above). It is estimated that as many as 50% of all adult kidneys contain cysts. Some cysts are congenital, some acquired and in some cases a distinction cannot be made (Papper, 1971).

Hereditary defects of the renal tubules (renal glycosuria, cystinuria, renal tubular acidosis and nephrogenic diabetes insipidus); polycystic kidneys and other forms of cystic renal disease are inborn errors of metabolism which allow the accumulation of a nephrotoxic substance which produces secondary renal damage (Worthen, 1968).

There are three types of congenital renal cysts: (1) polycystic kidneys, (2) single or multiple serous cysts, and (3) lymphatic cysts. Simple (solitary) cysts may be similar in origin to polycystic kidneys; the difference may be merely one of degree. However, whether simple cysts are congenital or acquired is not clear. In animals, simple cysts of the kidneys have been produced by causing tubular obstruction and local ischemia, which suggests that the lesion can be acquired (Smith, 1972).

Renal failure. Disease, injury, or drug intoxication can so interfere with normal kidney function that the kidneys actually fail to maintain man's internal equilibrium. Each kidney contains nearly one million nephrons or filtering systems. Man can live on one third of a kidney, or essentially 300,000 nephrons (DHEW, 1972). However renal failure will occur if the degree of renal insufficiency causes substantial alterations in plasma biochemistry. There are two forms of renal failure--chronic and acute--though no agreed line between the two exists.

Acute renal failure is defined by HEW as "any condition in which the daily volume of urine passed into the bladder is suddenly reduced below 400 ml." When this occurs, the kidneys can suddenly cease to function. It can be fatal unless the patient has access to an artificial kidney. The artificial kidney removes wastes, restores chemical balance, and allows the damaged kidney rest. The damaged kidney can sometimes recover to normal functioning when given this rest (U.S. Department of HEW, 1967).

Chronic renal failure consists of a "persistent impairment of both glomerular and tubular function of gradual onset and of such severity that the kidneys are no longer able to keep the internal environment normal." (deWardener, 1973). The end-result of chronic renal failure is the loss of renal function and the development of the clinical state of "uremia." (Blainey, 1972).

Calculi of the Urinary System. When crystals of chemical substances are present in the urine, they may form calculi at any level in the urinary tract (kidney through bladder) obstructing the drainage system of the kidneys. These chemical substances may consist of: uric acid and urates, calcium oxalate, and calcium and ammonio-magnesium phosphate formations. Ninety percent of all renal stones are composed of calcium; while 8% are composed of uric acid and 1 to 20% are cystine stones. Calculi vary in size from pinhead "gravel" to stones as large as walnuts (Kronfield, 1974).

Commonly, occurence is secondary to an infectious process in the tract and may be associated with metabolic diseases, though there may be no predisposing cause. Urinary tract stones may cause painful renal "colic," or a painless obstruction may in turn cause kidney damage from the pressure of urine as it collects behind the obstructed area. Damage may progress to renal insufficiency and uremia before the presence of the calculi is suspected (Kronfield, 1974).

Symptoms of Ill--Defined Conditions of the Urinary System

Uremia. Literally uremia means urine in the blood, however it also refers to the retention of nitrogenous and other metabolic waste products in the blood. It results from the failure of the kidneys to perform their primary function. Acute uremia may be caused by drug intoxication, especially barbiturate overdose; severe burns, which cause a fluid shift; hypotension during anesthesia, which may starve the kidneys; or crushing injuries, which trigger a mechanism which diverts the blood to the brain or the heart. Acute renal failure can cause uremia of short duration, but hemodialysis may be necessary to rid the body of waste products and water while the kidneys recuperate. It may be a matter of days or weeks before the kidneys "open up" and start again to produce ruine and perform their vital functions (U.S. Department of HEW, 1972, p. 9).

The symptoms of uremia include headache, drowsiness, diarrhea, itching, high blood pressure, etc. when wastes build up in the blood stream. A guide prepared by the U.S. Department of HEW (1967) lists the following manifestations of uremia:

1. Central Nervous System Effect - earlier symptoms are depression and drowsiness, which progress to frank confusion and finally to coma. The patient may have acute psychotic episodes, and convulsive seizures are not uncommon. A variety of defects in sensory and motor functions of the nerves may occur. These are called peripheral neuropathies. Pains may be experienced in the extremities accompanied by twitching of the muscles and loss of sensation in various areas.

2. Cardiac Manifestation - high blood pressure is common in uremia and may be stable or rapidly progressive. As a result of the high blood pressure, congestive heart failure may occur with accumulation of fluid in lungs and extremities. Swelling of the tissues is frequently present and may be due to heart failure or to loss of protein from the circulation, loss of salt, or combinations of all three factors.

3. Gastrointestinal Manifestations - another of the earlier signs of uremia is loss of appetiti, which progresses to nausea and vomiting. Diarrhea may be a problem in the late stages of uremia. Bleeding from the gastrointestinal tract occurs in many patients.

4. Skin Manifestations - generalized itching is a common symptom of uremia. The skin shows a tendency toward abnormally dark pigmentation due to deposits of urinary pigments. Crystals of urea are sometimes seen on the skin, giving rise to the descriptive term "uremic frost" (U.S. Depart-

of HEW, 1967, p. 18).

Bleumle, et al. (1970) describe the array of abnormalities which comprise uremia by the following methods.

1. A description of the approximate sequence in which these changes occur as kidney tissue and its function are progressively destroyed.

2. By grouping the changes according to organ-system involvement.

3. By organizing all abnormalities attributable to uremia according to the level of biological organization at which they are detected.

An example of the first method describes the etiology of uremia as slight (and later more marked) azotemia, metabolic acidosis, rising phosphate and usually falling calcium concentrations, and edema or volume deficits which express the declining ability of the kidneys to fulfill their primary role in maintaining control of body composition. As the syndrome evolves, the patient or physician notes subtle mental sluggishness, impaired ability to focus attention, personality changes involving withdrawal, or labile emotions and irritability, shortened attention span, deficient performance of mental arithmetic malaise, anoxexia, speaking in shorter sentences, apathy, waning sexual interest and potential, yellowish discoloration of skin and sclerae, pallor, episodic insomnia, fellings of coldness and measurable hypothermai, weakness, sleep-inversion, nausea, vomiting, itching, vasomotor instability, drowsiness, confusion, delusions and hallucinations, tremor and fasciculations, asterexes, twitching, paresthesia, delirium, psychosis, pericarditis, purpura, and gastrointestinal bleeding. Perihilar infiltrates in the lungs and evidence of osteodystrophy appear on X-ray. Breathlessness related to heart failure may be caused by anemia and hypertension. The mass of adipose and muscle tissue (i.e., the carcass) declines while the viscera, apart from the diseased kidneys, generally do not seem to share in the chronic wasting process. Numbness, "burning feet" and slowed nerve conduction velocity, indicate neuropathy, while cone pain usually suggests pathological fracture. Except for "flash-backs" of lucidity, the untreated patient becomes progressively worse, with convulsions coma prior to death.

The syndrome is the same in uremia regardless of what disease originally caused the renal failure (U.S. Department of HEW, 1967). The development of neurological abnormalities is generally the first indication for initiation of dialysis and the best therapy is considered to be sufficient dialysis or renal transplantation (Moncrief & Decherd, 1975). As long as no more severe muscular atrophy has developed, there is a real chance for full rehabilitation (Reichenmuller et al., 1972).

II. Societal Characteristics of Persons with Kidney Disease

The literature prevalence, incidence, mortality, and cost information about persons with kidney disease.

Prevalence and Incidence

Prevalence. Recent samplings have indicated that at least 3,300,000 Americans have unrecognized undiagnosed diseases of the kidneys. Ninety percent of these are female. The most common urinary tract disease is a mild infection usually undetected or ignored (U.S. Department of HEW, 1967; 1973; Hallen et al., 1968).

The National Center for health Statistics (NCHS) estimates some 7.8 million cases of kidney disease in a one-year period beginning June, 1964. During this time, kidney disease accounted for some 140 million days of restricted activity, 63.4 million days of bed disability and 17 million workloss days (Hallen, et al., 1968).

There are 2-3 million walking undiagnosed kidney disease patients in the United States. 20,000 Americans are currently on dialysis (National Kidney Foundation) tel.con.

"Horseshoe Kidney"--is the most common of all kidney diseases, and is twice as common in males.

Renal Fusion--about 1 out of 1,000 individuals has some type of renal fusion (Smith, 1972).

Renal Anomalies--congenital malformation of the kidney and urinary tract occur in 5% of all individuals (Geschickter & Antonovych, 1971).

Renal Artery Stenosis--many patients without hypertension have angiographic evidence of renal artery stenosis. The prevalence of angiographic lesions in the general hypertensive population is not known but in hospital-based surveys, the incidence ranges from 6-37%, in most instances reflecting highly selected populations composed of patients likely to have renal artery disease (Kirkendall, 1975).

Incidence. Benign tumors of the kidney--the most common of these are cortical adenomas of insignificant size. Their occurrence is most frequent in patients hwo have had chronic pyelonephritis and they are usually found incidentally at autopsy. The estimated incidence of these neoplasms approximates 10% (Geschickter & Antonovych, 1971).

Pyelonephritis--is a relatively common disease and one of the more common causes of serious infection. The exact frequency in clinical practice is difficult to determine becasue of uncertainties about diagnostic criteria (Black, 1972). During the nine-year period from 1948 to 1956 at the Massachusetts General Hospital, pyelonephritis accounted for 0.6% of admissions (Colby, 1959). In a study of 1000+ autopsies at the Boston City Hospital for the year 1965-66, pyelonephritis was identified in 4.3% of the cases (Black, 1972).

Polycystic Disease of Kidneys--is a heredity malformation usually found in newborns or in adults who survive into the third decade of life. It is usually a bilateral condition although one kidney may be more seriously affected than the other. The incidence of polycystic disease is estimated to be 1:350 births and 1:200 stillbirths (Geschickter & Antonovych, 1974).

Chronic Glomerulonephritis--the incidence of chronic glomerulonephriappears to be about 1% with males affected more than females 3:2. The figures are based largely on autopsy materials. It is suggested that about one-fourth of hospital patients who die of chronic "urerera" have this lesion (Hardwicke & Lannigan, 1968).

LeSourd, et al. (1968) report that glomerulonephritis and pyelonephritis account for more than 90% of the annual incidence of end-state uremia.

Unilateral agenesis due to the failure of one ureteral bud, consistent with normal life occurs once in 100 or 1500 births (Papper, 1971).

Terminal Renal Failure--the expected annual incidence of terminal renal failure varies widely - depending on the area and age limits adopted. For example, in South Wales the incidence is anticipated at 28 new cases per million per year with an upper age limit of 50 years. In Sweden, 75 new cases per million per year are anticipated with no age limit. This leads to the suggestion that 40 patients per million is a realistic annual incidence figure of new cases suitable for treatment (Sweatmen, et al., 1974).

Childhood Nephrosis - 4,000 children between 1 and 6 years of age are stricken with childhood nephrosis annually (South Plains Kidney Foundation, Lubbock, Texas (undated).

In his study of renal disease in children, T.M. Barratt (1974) estimates an annual indicence of approximatley 9 per million total population. He states that a pediatrician caring for a population of 100,000 may see one new case of childhood nephrosis per year and a general practitioner may see one case in his professional lifetime.

Renal Stones - the exact incidence cannot be estimated because many patients pass stones spontaneously. However, one person in 1000 is hospitalized each year because of renal stones which accounts for roughly 150,000-200,000 hospital admissions in the U.S. alone (Kolb, 1975).

Nephrotic Syndrome - in children 75-80% have the so-called idiopathic nephrotic syndrome or lipoid nephrosis, 15-20% have glomerulonephritis, and 5% have the syndrome or manifestation of systemic disease, such as lupus erythematosus (Barnett & Edelmann, 1972).

Wilm's Tumor associated with hypertension--in 11 out of 41 children treated for Wilm's Tumor at the Children's Medical Center in Dallas, hypertension was present. The incidence approached 40% in some series. Hypertension is thought to be secondary to increased renin production, and reversible by complete removal of the neoplasm. Hyaluronic acid production is usually increased (Peters, 1975).

Acute renal failure--it is believed that the incidence of acute renal failure will increase due to the steady rise of traffic and industrial accidents, and to the ever increasing range of chemical substances which are potentially nephrotoxic (Brod, 1973).

Mortality--Kidney disease ranks fourth as a cause of death in the U.S. today (LeSourd et al., 1968). It kills approximately 100,000 Americans annually (South Plains Kidney Foundation, undated).

In 1964, the death rate was 17.2 per 100,000 population. While mortality from "major urinary diseases" has apparently declined since 1900, actual deaths from diseases associated with this category are generally underreported (Hallan et al., 1968). Between July, 1964 and June, 1965, kidney diseases were responsible for the deaths of 58,783 Americans (Goodman, 1969). See Table 2.

According to studies by the National Kidney Foundation, at least 60,000 persons of both sexes and all ages die each year of some form of disease of the kidnesy (National Kidney Foundation, undated). A recent national report on kidney disease published by the Massachusetts Kidney Disease Planning Project agrees with the above mortality figures and reports that approximately 63,000 Americans died of kidney disease in 1964. They estimated that of this number, 7,000 could have been saved by dialysis (Donation of Kidneys, 1975).

In the 1971 statistics on kidney disease published by the European Dialysis and Transplant Association, it is reported that patients on home dialysis have a one year survival rate of 92% (only 8% die of all causes within the first year), and at five years the survival rate is 77%. The corresponding rates for patients who continue on hospital dialysis are 83% within the first year and 52% at five years (Coles, 1974).

Renal disease--vital statistics of the Unites States for the year 1964 listed 24,949 deaths due directly to renal disease. Of these, 11, 079 were due to chronic nephritis and 13,870 due to other diseases of the urinary tract. More than 9,889 deaths in the last group were attributed to infections. It is recognized however, that the deaths directly attributed to renal disease represent only a part os the total number of deaths in which renal disease was the primary cause. Many patients whose death certificate lists septicemia also have an underlying renal lesion. The National Kidney Foundation has estimated that at least 100,000 deaths occur each year as a result of various diseases of the kidneys or complications of such disease (U.S. Department of HEW, 1967).

Renal failure of both kidneys--in otherwise normal individuals, when both kidneys cease to function for any reasons and no medical care is available, death inevitably follows within three to four weeks (National Kidney Foundation, undated).

Kidney failure--it is estimated that 55,000 Americans of both sexes and all ages die each year of irreversibly kidney failure (U.S. Department of HEW, 1973).

Nephroblastoma or Wilm's Tumor comprises about 6% of malignant renal

TABLE 5-2

ANALYSIS OF 100 CASES OF DEATH IN UREMIA

DIAGNOSIS	NUMBER OF CASES
Pyelonephritis	57
Glomerulonephritis	30
Nephrosclerosis	13

Source: P. Kimmelstied, "Significance of Chronic Pyelonephritis," Biology of Pyelonephritis, E. L. Suinn & E. H. Kass (Eds.) Boston, Mass.: Little, Brown & Co., 1969, p. 218.

tumors and accounts for one-fifth of fatal cancers in children.

Renal cell cancer--Rafla reviewed 244 patients with renal cell cancer. The majority of patients in whom distant metastasis eventually developed it within two years of the primary diagnosis (176 or 72%). Survival for the patient with metastatic disease was similar no matter which organ system (lung or bone) was involved (9-11 months) but with multiple-organ metastases, survival was significatnly longer (16-24 months). Lokich et al., (1975) report on a study in which it was found that patients with multiple-organ metastases had a longer survival (20 months) compared to single-organ metastasis (9 months). The explanation for this paradoxical statistic is obscure but may be related to immunologic host factors (Lokich & Harrison, 1975).

Malignant tumors of the kidney--mortality due to this kidney disease accounts for 4.3 per 100,000 deaths in the United States annually. The present known death rate from malignancies of the kidney may be increasing and some reports indicate mortality is 50% higher than that reported two decades ago (Wagle et al., 1975).

Pyelonephritis--in its chronic form, is one of the most common causes of uremic death in adults past middle life. Evidence of pyelonephritis is in 10% of all autopsies (Schickter & Antonovych, 1971).

Renal Agenesis--in a study conducted on 50 infants, 19 of the infants (38%) were stillborn and 31 (62%) were born alive. Twenty-six of the live-born infants lived less than four hours and the longest survival was 48 hours (Peters, 1975).

Nephritis--a substantial decrease has been observed in deaths from chronic nephritis over the last decade. This trend has also been seen in deaths from acute nephritis and nephrosis. The true decrease in incidence is probably a reflection of the advent of chemotherapeutic agents.

There is no apparent correlation between the number of deaths from particular kidney disease and the expenditure for research for particular disease catefories. The following table summarizes expenditures for research and mortality rates for major disease groupings.

Costs of Kidney Disease*

The economic impact of kidney disease reached $3.6 billion during 1964. The total economic costs of kidney disease are categorized into direct and indirect cost. Direct costs (totaling $1.2 billion in 1964) are again divided into personal and non-personal service cost. Non-personal services include research, training, other health services, construction and the net cost of insurance. Personal services and supplies include hospital care, nursing home care, professional services and drugs. In 1964, the national health expenditure for non-personal services related to urinary disease totaled approximately $179million; $229 million (12.8 percent) was spent for medical research and the remaining $156.3 million for other non-personal services. An estimated $8.6 million was spent for other health and medical services and activities. It is estimated that $67.5 million was spent for construction of medical facilities related to some aspect of urinary disease and related diseases. (See Table 3)

The indirect economic costs of kidney disease are described as potential output losses from morbidity and mortality. Income loss due to morbidity is measured in terms of loss of productivity, and output loss due to premature mortality is measured in terms of future losses of income. In 1964, total indirect cost for males and females was estimated a $2.4 billion. For males the total indirect cost was estimated at $1.5 billion and for females, $910 million. The higher indirect costs attributable to males are partly due to the higher rates of mortality and higher earnings in the labor force; however, the male population accounted for 14,000 lost man-years compared to the female population with a loss of 208,000.

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*The information in this section is taken from a report prepared by Hallan, Harris, & Alhadeff (1968) of the Research Triangle Institute for the U.S. Department of HEW, Public Health Service.

The total economic costs of kidney disease are summarized in Tables 5-3, 5-4 and 5-5. Table 5-4 excludes expenditures for non-personal services and Table 5-5 shows total economic costs of non-personal services.

The total cost of kidney disease and its associated diseases amounted to a total of 5.4 percent of our estimated National Health expenditure. Therefore, in terms of cost to this nation, kidney disease was ranked fifth among all diseases in 1965 (Goodman, 1969).

III. Demographics

Age--congenital and hereditary kidney disorders play a larger role in childhood kidney disease while degenerative diseases play a much smaller role.

Childhood Nephrosis--occurs most frequently in young children between the ages of 1 1/2 and 4 years. It can also infrequently affect adults (NKF undated).

Nephrotic Syndrome--the incidence in relation to age and sex depends largely on its etiology. Cases can be divided into those in whom the renal lesion is primary and those in whom it is only a feature in a more generalized disease. The primary lesions are more common in children and in men under the age of 60; whereas when the lesion is a feature in a generalized

TABLE 5-3

TOTAL DIRECT COST OF PERSONAL SERVICES AND SUPPLIES FOR THE TREATMENT OF PATIENTS WITH KIDNEY DISEASE AND RELATED DISEASES OF THE URINARY SYSTEM BY AGE GROUPS, 1964

Disease Category	All ages	Age 0-14	15-44	45-64	65+
Total Direct Costs	$1,044,029	$125,866	$325,996	$260,932	$331,235
Major urinary diseases:					
Nephritis and nephrosis	43,622	8,729	16,617	10,994	7,282
Congenital malformations of the urinary system	20,392	4,223	9,023	6,104	1,042
Neoplasms of the urinary system	50,088	4,634	9,842	9,077	26,535
Symptoms and ill-defined conditions of the urinary system	71,547	11,490	22,285	17,080	20,692
Other diseases of the urinary system[1]	544,499	73,783	212,118	145,242	113,356
Selected diseases with involvement of the urinary system:					
Diseases of the prostrate	232,533	16,057	37,558	48,191	130,747
Diabetes mellitus	28,394	2,959	8,310	6,567	10,558
Hypertensive disease	52,235	3,876	9,886	17,500	20,973
Injury to pelvic organs	614	96	322	157	39
Poisoning	85	19	35	20	11

[1] Includes calculi and infections of the urinary system.

Source: Hallan, et al. (Research Triange Institute), 1968, p. 11.

TABLE 5-4

ECONOMIC COSTS[1] OF KIDNEY DISEASE AND OTHER DISEASES OF THE URINARY SYSTEM, MALES AND FEMALES, BY AGE GROUPS, 1964

(THOUSANDS OF DOLLARS)

Disease Category		Age			
	All ages	0-14	15-45	45-64	65+
Economic Costs (direct & indirect)					
Total	$3,456,267	$178,273	$1,014,390	$1,265,154	$998,450
Major urinary diseases:					
Nephritis & nephrosis	522,228	23,175	229,654	200,784	68,615
Congenital malformations of the urinary system	86,150	21,360	29,663	31,015	4,142
Neoplasms of the urinary system	367,065	12,172	52,700	190,917	110,736
Symptoms and ill-defined conditions of the urinary system	106,216	11,527	33,407	28,663	32,619
Other diseases of the urinary system[2]	1,318,712	85,005	521,338	424,466	287,903
Selected diseases with involvement of the urinary system					
Diseases of the protrate	589,263	16,245	57,890	212,003	312,125
Diabetes mellitus	189,670	3,919	42,438	72,961	70,352
Hypertensive disease	261,051	3,932	42,963	102,748	111,408
Injury to pelvic organs	5,792	346	3,692	1,249	505
Poisoning	1,120	52	675	348	45

[1] Excludes expenditures for non-personal services

[2] Includes infections and calculi of the urinary system.

Source: Hallan, et al.,(Research Triangle Institute), 1968, p. 13

TABLE 5-5

TOTAL ECONOMIC COSTS OF KIDNEY DISEASE AND RELATED DISEASES OF THE URINARY SYSTEM, BY TYPE OF COSTS, 1964

(DOLLARS IN MILLIONS)

Type of Cost	Amount	% of Total
Total economic costs (direct & indirect)	$3,635	100.0
Direct costs, subtotal	1,223	34.0
Nonpersonal services	179	5.0
Research	23	.6
Training	9	.3
Other Health Services	30	.8
Construction	67	1.8
Net cost of insurance	50	1.4
Personal services and supplies	1,044	29.0
Hospital Care	484	13.0
Nursing Home Care	18	1.0
Professional Services	400	11.0
Drugs	142	4.0
Indirect costs, subtotal	2,412	66.0
Morbidity	984	27.0
Mortality	1,428	39.0

Source: Hallan, et al. (Research Triangle Institute, 1968, p. 17.

disease, the patients are mainly adults (DeWardener, 1973).

Glomerulonephritis--most often occurs in childhood and adolescence in males. The frequency is greatest at school age. Some regard this as an indication of a transmissible cause, at least in certain cases. The frequency of the condition diminishes with age but no age is immune - it also occurs in old people and infants (Hamburger et al., 1966).

Polycystic Renal Disease--the average age of onset is 40 years (Becker, 1973).

Secondary Renal Carcinomas--the average age of onset is 53 years, however, it has been reported to occur from ages 4 to 85 (Wagle et al., 1975).

The incidence of malignancy and atherosclerotic disease increases with age. It appears to be a less well-known form of kidney disease which evidences itself as a slow deterioration of renal function with age, probably due to a steady loss of nephrons.

Sex--kidney disease in general is somewhat uncommon in males and affect females with twice the frequency of males.

Nephrotic Syndrome--when the renal lesion is promary, this disease is more common in males but when the lesion is a feature in a generalized disease, the patients are equally distributed between the sexes (DeWardener, 1973).

Glomerulonephritis--is twice as common in boys although this predominance is not found in adult males (Hamburger et al., 1966).

Polycystic Kidney Disease--there is no significant sex difference in the occurence of this kidney disease.

Secondary Renal Carcinoma--the distribution of incidence is about equal between the sexes.

Ethnicity--Renal artery stenosis--considering the low incidence of renal artery stenosis in the black population and the relatively high percentage of blacks in the hypertensive population, it is likely that no greater than 10-15% of the hypertensive population have renal artery lesions, and less than half of these lesions are important in the hypertension of the patient (Kirkendall, 1975).

Geographic Areas--no patterns of geographic distribution have been observed in kidney disease.

IV. Etiology

Infectious Diseases of the Kidney

Pyelonephritis--may develop as a result of microorganisms entering the kidney through the bloodstream or urinary tract (U.S. Department of HEW, 1973). In the majority of cases, the causative infection follows some form of urinary tract obstruction. In general, any factor causing obstruction in the urinary tract may be favorable to the development of pyelonephritis. Examples are pregnancy, prostrate enlargement, congenital anomalies and laxity of pelvic muscles following multiple pregnancies. Additional conditions causing kidney infections may be the presence of foreign bodies such as renal calculi or an indwelling catheter, or associated diabetes mellitus (Cramond et al., 1968).

Inadequate treatment of pyelonephritis can lead to cessation of the warning symptoms while the destructive process continues (U.S. Department of HEW, 1967). This, in turn, can lead to chronic pyelonephritis followed by renal failure and death.

Black (1972) notes a number of predisposing conditions linked to chronic bacterial pyelonephritis (see below):

1. Urinary obstruction
    (a) Congenital
    (b) Acquired

2. Vesico-ureteral reflux
3. Neurological and muscular disorders of the bladder or ureters
4. Stones and nephrocarcinosis
5. Polycystic disease and other congenital renal dysplasias
6. Ischaemic disease of the kidneys; renal artery obstruction; nephrosclerosis; hypoplasia
7. Systemic disorders of host resistance
8. Diabetes mellitus, intercapillary glomeruloscolerosis

Non-Infectious Diseases of the Kidneys.

Glomerulonephritis. Glomerulonephritis ranks second only to pyelonephritis as the cause of extensive renal pathology. It may exist as an acute, self-limited disease characterized by complete and spontaneous healing; or it may be associated with progressive nephron destruction leading ultimately to renal failure and death from uremia (Bricker & Slatopolsky, 1965). Retrospective studies indicate 10% had remission rates of up to 30 years (essentially full recovery without acquiring chronic glomerulonephritis).

The majority of acute glomerulonephritis cases are preceeded by an upper respiratory infection caused by hercolytic streptococcus. The available evidence indicates that infection with streptococcus or other microorganisms induces a type of internal allergy in the individual's kidney tissues.

Acute glomerulonephritis usually affects both kidneys, although streptococcus infection of the kidneys does not take place except when a generalized body infection (septicemia) is also present (U.S. Department of HEW, 1967; 1973).

Strepoccal glomerulonephritis probably accounts for only a small number of chronic glomerulonephritis cases. However, the chronic form of the disease may begin as an acute illness following a streptococcal infection and progress through sequential phases of nephron destruction over a period of months to years (Bricker & Slatopolsky, 1965). In the chronic form, which accounts for about 25% of the total number of terminal uremia cases, there are usually no symptoms for many years. Patients with this form suffer slow but progressive kidney damage which will ultimately be fatal (U.S. Department of HEW, 1973).

Nephrosis. The nephrotic syndrome occurs in a variety of pathological conditions involving the glomeruli, leading some clinicians and pathologists to regard this syndrome as a form of glomerulonephritis. Blache et al., (1974) and Robson (1974) give support to this contention noting the majority of cases of the nephrotic syndrome arise as a result of glomerulonephritis; others believe it to be an entirely independent entity (Brod, 1973).

There is much confusion about the syndrome among researchers and clinicians, due in part to the dearth of information about its etiology and the rigidity of the kidney classification system (Blainey, 1972). It is sometimes ambiguously defined as a conditions with many causes but with three common clinical and biochemical manifestations: edema, extensive proteinuria, and reduced serum albumin. Edema, which is characterized by the accumulation of large quantities of fluid in the body, is the most often acknowledged symptom of the nephrotic syndrome. Usually, it is the cosmetic or painful aspects of edema which bring patients to the physician in the first place (Melky, 1972).

Table 5-6 lists a variety of possible causes of the nephrotic symdrome. Included within this listing are glomerular, systemic and circulatory diseases; along with nephrotoxins, allergens, and drugs, and diseases due to infection. There are also associations with certain hereditary factors as well as pregnancy, transplantation, cyclic recurrence and intestianl lymphangiectasia.

TABLE 5-6

CAUSES OF THE NEPHRITOC SYNDROME

- Glomerular disease
  - Minimal change
  - Idiopathic membranous
  - Proliferative
    - Acute
    - Subacute
    - Chronic
  - Lobular

- Metabolic disease
  - Diffuse and nodular diabetic glomerulosclerosis
  - Amyloidosis
  - Myxedema

- Systemic diseases
  - Collagen vascular disease
    - Systemic lupus erythematosus
    - Periateritis
    - Goodpasture's syndrome
    - Dermatomyositis
    - Central pontine myelinolysis
    - Takayasu disease
    - Erythema multiforme
  - Malignant diseases
    - Hodgkin's disease
    - Multiple myeloma
    - Lymphocytic leukemia
    - Adult carcinomas

- Circulatory diseases
  - Sickle cell anemia
  - Spherocytosis
  - Renal artery stenosis
  - Renal vein thrombosis
  - Pulmonary artery thrombosis
  - Inferior vena cava stenosis or thrombosis
  - Constrictive pericarditis
  - Congestive heart failure
  - Tricuspid valvular insufficiency
  - Pheochromocytoma

- Nephrotoxins
  - Organic mercurial diuretics
  - Ammoniated mercury ointment
  - Inorganic mercury
  - Bismuth
  - Gold

- Allergens and drugs
  - Pollen
  - Bee stings
  - Poison oak, poison ivy and "purified" Rhus toxin
  - Trimethadione and paramethadione
  - Insect repellents
  - Snake bites
  - Probenecid
  - Penicillamine
  - Miscellaneous allergens and serum therapy, er, wool, "cold pills", globulin and poliomyelitis vaccine

- Diseases due to infection
  - Cytomegalic inclusion disease
  - Syphillis
  - Malaria (especially Plasmodium)
  - Typhus
  - Chronic jejunoileitis
  - Tuberculosis
  - Subacute bacterial endocarditis
  - Herpes zester
  - Miscellaneous bacteremia

- Congenital nephrotic syndrome

- Hereditofamilial nephritis

- Pregnancy

- Transplantation

- Cyclic recurrence

- Intestinal lymphangiectasia

Source: James, 1972

According to James (1972), there are specific causative factors of nephrotic syndrome in children. These are noted below:

1. Associated with primary renal parenchymal disease of known or unknown cause

    a. Acute glomerulonephritis (transient)
    b. Membranoproliferative glomerulonephritis
    c. Familial glomerulonephritis (uncommon)
    d. Other types of persistent (chronic) glomerulonephritis

2. Circulatory Disorders

    a. Renal vein thrombosis
    b. Constrictive pericarditis
    c. Chronic congestive heart failure

3. Congenital

    a. Familial
    b. Non-familial

4. Toxic, drug induced

    a. Trimethadione
    b. Penicillamine
    c. Gold salts, heavy metals
    d. Bee stings

5. Secondary to renal involvement in other systemic diseases

    a. Congenital or acquired syphiilis
    b. Systemic lupus erythematosus
    c. Schonlein-Henoch purpura
    d. Diabetes mellitus
    e. Shunt nephritis
    f. Amyloid disease
    g. Subacute bacterial endocarditis
    h. Malaria
    i. Sickle cell disease

6. Idiopathic

    a. Minimal change disease
    b. Other varieties, overlapping with Group 1

Idiopathic causes give rise to 80% of nephrotic syndrome cases in children (James, 1972).

In adults, 20% have the idiopathic form of the disease; while the majority have some form of glomerulunephritis or a systemic disease like lupus erythematosus (SLE) or diabetes (Barnett & Edelmann, 1972).

Nephritis

Interstitial Nephritis--implies inflammatory involvement of the supporting intertubular connective tissues in the absence of primary glomerular damage. Inflammation is not of bacterial origin or primarily due to ischaemia (blood vessel constriction) although both factors may later be complicating factors (Williams, 1973). In its acute form, interstitial nephritis may arise as an allergy to drugs (phenindione or sulphonamides) producing albuminuria, oliguria or acute renal failure which may be fatal. In a study conducted in Britain, it was found that the chronic form of interstitial nephritis may be complicated by high dosages of analgesics (particularly phenacetin). This produces interstitial inflammation, fibrosis and in severe cases, a necrosis of the renal papellae. Clinical improvement usually follows withdrawal of the drug (Williams, 1973).

Hereditary Nephritis--There are two major hypotheses associated with the etiology of hereditary chronic nephritis: (1) the disease is transmitted by partially sex-linked dominant inheritance, and (2) the disease is transmitted by preferential segregation and chromosomal association (Perkoff, 1971).

Renal Carcinoma--According to Bennington and Kradjian (1967): "While many of the factors or agents responsible for the production of renal carcinomas in animals other than man have been implicated as being responsible for renal carcinomas in human, there is little clinical evidence to support these theories" (p. 38). However, a number of possible causal factors have been cited: heredity, early development of metastatic diseases, infectious agents, sex hormones, chemical agents, physical agents, poor health habits (Lokich & Harrison, 1975; Bennington & Kradjian, 1967).

Congenital Abnormalities of the Kidneys--Abnormalities occur more frequently than anomalies in any other organ of the body. Some kidney abnormalities can be ascribed to errors at specific developmental stages. (See Table 7. These include the following: (Blainey, 1972)

1. Anomalies of number are caused by a disturbance of the development of the metanephrogenic blastema and the ureter. Aplasia (lack of development of an organ) and hypoplasia (defective or incomplete development) of one kidney are found in about one case per million of all autopsies. However, double ureter or double kidney are more frequent anomalies (Brod, 1973). Supernumerary kidneys are located in an abnormal position and are smaller than normal. The abnormality results from an incorrect division of the ureteric bud; and the organs on the affected side may either open independently into the bladder or into a common ureter, according to the site of the division (Blainey, 1972). The presence of more than two kidneys is very rare (Smith, 1972).

The absence of one kidney is probably due to the ureteral bud's (from the Wolffian duct) failure to develop or, if it does develop, arrested growth e.g., it does not reach the metanephros (adult kidney). Without a drainage system, the metanephros mass undergoes atrophy. The ureter is usually absent on the side of the unformed kidney, although a blind duct may be found (Smith, 1973).

Indications of bilateral renal agenesis at birth are manifested in presenile appearance of the child, a small amount of amniotic fluid, and the absence of urine as well as other clues (Papper, 1971).

2. Anomalies of Size or Volume. This occurs in the condition known as Polycystic Kidneys, which is a hereditary disease and almost always bilateral. Kidneys are usually much larger than normal and studded with cysts of various sizes (Smith, 1972).

TABLE 5-7

NUMBER AND TYPE OF CONGENITAL MALFORMATIONS OF THE URINARY SYSTEM

Type of malformation	Number of Instances*			Percent of total studied
	Live-born	Stillborn & neonatal deaths	Total	
Urinary system, total	1	31	32	0.055
Absence of kidney	---	2	2	.03
Malformations of renal pelvis	---	5	5	.08
Polycystic disease of kidney	---	4	4	.07
Hydronephrosis	---	4	4	.07
Other malformation of kidney	---	3	3	.05
Hydroureter	---	4	4	.07
Other malformation of ureter	---	2	2	.03
Extrophy of bladder	---	2	2	.03
Hypoplasia of bladder	---	1	1	.03
Malformations of urachus	---	2	2	.03
Atresia of urethra	1	2	3	.05
Stricture of meatus	1	---	1	.02

*N = 5,964 pregnancies

Source: Hallan, Harris & Alhadeff, 1968.

Hypoplasia implies a smaller than normal kidney. The total renal mass may be divided in an unequal manner (i.e., one small kidney and one large). Some congenitally small kidneys prove on pathologic examination to be dysplastic (abnormally developed) (Smith, 1972).

3. Congenital Anomalies of Renal Position or Location. "Migration of the kidneys in a cranial direction during embryogenesis is probably due to pressure from the rapidly developing small intestine. If this pressure is stronger and is exerted at an earlier stage than usual, it can prevent the kidneys from leaving the lesser pelvis or waist level which leads to renal dystopia or malposition of the kidney. Movement may be prevented mainly on one side or may be bilateral. Excessive asymmetrical pressure by the intestine can even lead to the kidney being displaced ot the other side (crossed dystopia)" (Brod, 1973, p. 537-538).

Bailey et al., describes ectopic kidneys as failing to ascend, ascending to a more cranial position than is normal, or deviating to one or the other side. High octopic kidneys may be associated with congenital defects in the diaphragm, or may be accompanied by eventration or protrusion of the bowels from the abdomen, of the diaphragm (Spillane & Prather, 1952; Barloon & Goodwin, 1957).

Ectopia, which may be unilateral or bilateral, makes the patient subject to infections and can cause pressure symptoms on adjacent pelvic organs. It is frequently confused with tumor masses (Papper, 1971).

4. Congenital Anomalies of the Reciprocal Relationship of the Two Kidneys (Median Line Fusion). This occurs when the adjacent poles of dystopic kidneys fuse. If dystopia is symmetrical and the lower poles (in 90% of cases) or more rarely, the upper poles (in 10%) of the kidneys are fused, the result is a horseshoe kidney. If both the upper and lower poles are fused, a cake kidney is formed. In crossed dystopia, fusion of

✓

the same two poles produces an L-shaped kidney, while fusion of the opposite poles (the lower pole of the higher situated kidney and the upper pole of the more caudally situated kidney) results in an S-shaped kidney (Brod, 1973). Cake kidney is an uncommon occurence. Sheller & Wiswell (1957) reported 10 cases and Glenn (1958) reported another.

By contrast horseshoe kidneys are not infrequently observed in the dissecting or post-mortem room.

5. Defective or Incomplete Development. Under normal circumstances the helium of the kidney is situated on the medial border of the organ. In cases of abnormal rotation, it may lie ventral, ventro-medial, lateral, or dorsal. The course taken by the renal vessels from the aorta to the point where they enter the organ may give some indication as to whether the rotation was clockwise or counter-clockwise in direction. The cause of this abnormality is not known (Bailey, 1972).

Abnormal Gestational Influences--are responsible for a single horseshoe kidney, pelvic displacement of one or both kidneys; double ureters; valve-like obstructions in the urinary tract and various renal cystic anomalies (Geschickter & Antonovych, 1971).

Obstructions of the Urinary Tract--predispose patient to infection and may cause urinary suppression. They are caused by stone formations produced by abnormalities of mineral metabolism or disease of the prostrate, uterus, or urethra (Geschickter & Antonovych, 1971).

Cystic Diseases of the Kidneys--Some cysts are congenital, others acquired and in some cases a distinction cannot be made (Papper, 1971).

Hereditary defects of the renal tubules (renal glycosuria, cystinuria, renal tubular acidosis and nephrogenic diabetes insipidus); polycystic kidneys and other forms of cystic renal disease are inborn errors of metabolism which allow the accumulation of a nephrotoxic substance which produces secondary renal damage (Worthen, 1968).

There are three types of congenital renal cysts: 1) polycystic kidneys, 2) single or multiple serous cysts, and 3) lymphatic cysts. Polycystic kidney disease is inherited as a Mendelian dominant character, the affected individuals being heterozygous for the particular abnormal gene (Blainey, 1972). In other words, if your parents have the disease, you have a 50% chance of inheriting it and if you have it, the same possibility exists for your children to inherit it (NKF, undated). The evidence suggests that the cysts occur due to defects in the development of the collecting and uriniferous tubules. The secretory tubules which are connected to functioning glomeruli become cystic; and as these cysts enlarge, they lead to compression of the adjacent parenchyma, destroying it by ischemia, and occlude normal tubules. The result is progressive functional impairment (Smith, 1972).

The almost completely adopted view of the cause in both adult and infant forms of polycystic kidney disease is the hereditary factor. When the abnormality is present at birth, it presumably represents the final stage of a process which has been going on throughout fetal life (Blainey, 1972).

Simple (Solitary) Cysts may be similar in origin to polycystic kidneys; the difference may be merely one of degree. However, whether simple cysts are congenital or acquired is not clear. In animals, simple cysts of the kidneys have been produced by causing tubular obstruction and local ischemia, which suggests that the lesion can be acquires (Smith, 1972).

Cystic Disease of the Renal Medulla--occurs in two different clinical syndromes. (1) "Medullary cystic disease," which usually appears during adolescence as an unexplained anemia, may lead to hypertension and death in uremia; (2) "Sponge kidney," which is usually asymptomatic in the absence of complications, is discovered by radiological examination.

Cystinuria--This occurs in two hereditary forms: Mendelian recessive and incompletely recessive cystinuria. Over 65% of patients develop stones in the kidneys which are undoubtedly a function of cystine cone attained in urine. When saturation level is reached, the patient's life is at risk. The cone is dependent on cystine excretion rate and volume of urine being formed, which are in turn dependent of fluid intake. Other factors which influences the development of cystinuria are malformations in renal tract structure, infections, and transfer to tropical climates with inadequate adjustment of fluid intake to maintain urine volume (Blainey, 1972).

Calculi of the Urinary System

The exact cause of most renal stones in unknown (Smith, 1972; Kolb, 1972). Occurrence may be secondary to urinary infection, associated with metabolic disease or have no apparent predisposing cause (U.S. Department of HEW, 1967). It is also possible, that multiple causative factors (known and unknown) are involved (Smith, 1972).

Urinary tract infections will cause stone formations of ammonium-magnesium phosphate and calcium, as well as enhance the severity of stones caused by metabolic dysfunctioning by: (1) precipitating changes in urinary pH; (2) decreasing protective substances; and (3) increasing the availability of stone matrix substance (Kluthe et al., 1972). According to Kronfield (1974) recent studies indicate magnesium, citrate, phosphates and certain polypeptides act as protective substances which prevent stone formation, and the absences of these substances may precipitate or enhance the tendency towards recurrent stone formation.

Recurrent renal stones may be the only clue to an underlying metabolic defect. The metabolic defect may or may not be familial in origin (i.e., parathyroid adenoma, hyperoxaluria, uric acid stone formation and cystinuria). Primary hyperparathyroidism (a condition in which tumors of the parathyroid glands or diffuse hyperplasia produce excess parathormone which mobilized skeletal calcium), results in increased levels of urinary calcium which promote stone formation (Williams, 1973).

Other causative factors include: (1) structural abnormalities--medullary sponge kidneys or calycial diverticula--which may provide the basis for stone formation and (2) dehydration, one of the principal causes of some types of stones. For example, an individual suffering from severe dehydration may precipitate a calcium oxalate or uric acid stone without any underlying metabolic abnormality (Kronfield, 1974).

Other Diseases of the Urinary System

Renal Infarction--is described as a coagulative ischemic necrosis of the kidney. It is a vascular disturbance which most often results from a blockage of the arterial blood supply. It may be due to thrombosis alone or in combination with atheroma or necrotising arthritis, embolism arterial injury or severe arterial spasm. Thrombosis of the renal vein is a rare cause, seen mostly in infants as a complication of dehydration.

A common cause of infarcts are embolus which consist of particles of solid material (e.g., broken off fragments of thrombi). Other and less common forms which may involve the kidney - often at glomerular level - include fat droplets following bone fractures or injury to subcutaneous fatty tissue, lipids and cholesterol from ulcerated atheromatous plagues and occasionally groups of malignant cells as a form of tumor spread (Williams, 1973).

Renal cortical necrosis, which is the most dramatic form of renal infarction, occurs mainly as a rare complication of pregnancy in association with placental apoplexy (hemorrhage into a centrally separated placenta with formation of a hematoma between the placenta and the uterine wall). The renal cortical necrosis of a vaso-spastic origin and sometimes complicated by thrombosis (formation of a plug or clot in a blood vessel or in one of the cavities of the heart, formed by coagulation of the blood and remaining at the point of its formation) within the spastic arteries. The lesion varies in severity from small focal infarcts to extensive confluent necrosis of the outside layers of both kidneys. In severe fatal forms, kidneys are swollen. Limited focal forms are not fatal as infarcts may undergo repair (Williams, 1973).

Hypertension--is usually not a treatable component in primary renal disease. Patients without hypertension survive longer than patients with hypertension. In patients with severe hypertension, the down hill course is rapid and death usually occurs in three months to two years in the absence of successful antihypertensive therapy. Control of hypertension in chronic renal disease requires the control of nitrogen balance by the use of diet and furosemide in order to avoid nitrogen depletion (Hull, 1975).

The exact etiology of hypertension is obscure, and the importance of the role of the kidneys in the development of hypertensive disease has been the source of much discussion. Secondary hypertension can be caused by neurogenic, endocrine and renal mechanisms; among the renal causes are glomerulonephritis, pylonephritis, acute renal ischemia, polycystic kidneys, renal artery obstruction, toxemia of preganncy, and involvement of the kidneys by generalized disease processes such as periarteritis nodosa and amyloidosis. Renal involvement is so common in hypertensive disease that his strongly implicates the kidneys in the pathogenesis. Renin, a protein of renal origin, has long been known to raise blood pressure in both man and animals (Hallan et al., 1968).

Diabetes--More than two dozen inborn errors of metabolism affect urinary excretion and renal failure. The most prevalent is diabetes mellitus, which alters renal vasculature, produces glycosuria, and predisposes to urinary infection. Gout and forms of amino aciduria and renal tubular acidosis are less common results of diabetes mellitus (Geschickter & Antonovych, 1971).

Renal diabetes is a disturbance in which glucose is excreted in the urine at a normal or only slightly elevated blood sugar level. It is most probably inherited and dependent on a single dominant gene. For cases of renal diabetes appearing during pregnancy, it is not clear whether the pregnancy acts as a provoking factor or whether renal diabetes represents an acquired type of lesion csused by hemoral and metabolic changes induced by pregnancy (Brod, 1973).

Phosphate diabetes (Vitamin D resistant rickets) is a very rare disease (present in some 0.04 per million children). It is transmitted by an X chromosome dominantly. This means that among descendents of the diseased mother, the affection is distributed with equal frequency between the sons and daughters, whereas a diseased father transmits it only to daughters. It appears that in diseased females the healthy X chromosome can damp the qualities of the abnormal second one, so that their anomaly may be less strongly expressed (Brod, 1973).

Examples of apparently inherited diabetes insipidus fall into two physiologically distinct classes: 1)Pitressin-sensitive diabetes insipidus-which appears to be determined by an abnormal autosomal gene for which the affected individual is heterozygous. There is a marked variation in degree of severity of disorder among heterozygotes in the same family. When only males are affected, transmission from one generation to the next appears to occur only through clinically normal females which leads to the suggestion that the condition is determined by an abnormal gene on an X chromosome (Blainey, 1972). Pitressin-insensitive or nephrogenic diabetes insipidus presumably results from some abnormality in the tubules which interferes with the reabsorption of water tha which makes them unresponsive to the anti-diuretic hormone (Blainey, 1972).

Nephrogenic diabetes insipidus is a disorder predominantly suffered by males. It is mostly determined by a gene on the X chromosome but sometimes is heterozygous for abnormal autosomal gene.

Hypercalcemia occuring with acute renal failure has been recognized as an associated disability for approximately ten years. The most likely source of the hypercalcemia appears to be the reabsorbtion of Ca from metastatic deposits in soft tissue and possibly from bone. The failure to incorporate Ca into the bone during the period of immobilization may explain the prolonged hypercalcemia.

Trauma or Injury to the Kidneys--occur most commonly during athletic activities or in industrial or traffic accidents. Ninety percent occur in males.

Direct Injuries:

1. Traffic accidents, usually automobile - 50%-60% of all renal injuries
2. Football - 30% of all renal injuries
3. Fall against the flank
4. Gunshot or stabbing (penetrating) incidence higher in areas of violence or in wartime.

Indirect Injuries:

1. Fall on the feet, buttocks or shoulders may cause the renal counterpart of the familiar whiplash kidney
2. The freely moving kidney, fixed only at its pedical, may continue its downward course, being torn free from its pedicle.
3. Mild trauma may rupture an abnormal kidney (hydronephrosis, Wilm's

tumor). (Smith, 1973; Wyker & Gillenwater, 1975).

Acute Renal Failure--The causes of acute renal failure are disease, injury, and toxic agents. Symptoms are decreased urine production, chemical imbalance, and waste buildup in the body (U.S. Department of HEW, 1967). DeWardener notes that acute renal failure inevitably includes severe but physiologically normal oliguria, sometimes called "Acute Renal Insufficiency" (p. 159).

In his book, DeWardener reports the etiology of acute renal failure as follows:

1. Severe functional changes without structural damage
2. Severe functional changes with acute structural damage
3. Functional changes of perhaps moderate severity but occuring in a patient with chronic structural damage
4. Acute urinary tract obstruction (p. 159).

The etiology and pathogenesis of acute renal failure in children is listed in J. A. James (1972) by the following classifications:

A. Prerenal Failure
   1. Circulatory insufficiency
      a. Gastroenteritis
      b. Diabetic acidosis
      c. Shock
      d. Burns
      e. Hemmorrhage
      f. Hypovolemia associated with nephrotic syndrome
   2. Renal arterial or venous occlusion
B. Renal Failure
   1. Nephrotoxins
      a. Bismuth, Hg, gold
      b. Ethylene glycol
      c. Carbon tetrachloride
      d. Incompatible blood transfusion
      e. Sulfonamides, kanamycin, polymycin B
      f. Salicylates, edetable disodium (Versenate)

2. Cortical ischemia
    a. Shock, hemmorrhage
    b. Trauma, burns
    c. Neonatal hypoxia
3. Diseases of kidney and vessels
    a. Glomerulonephritis
    b. Pyelonephritis
    c. Acute intestetial syndrome
    d. Hemolytic - uremic syndrome
    e. Polyarteritis
    f. Acute renal failure complicating chronic failure
4. Iatrogenic disorders
    a. Removal of solitary kidney
    b. Renal angiography
    c. Retrograde pyelography
5. Severe infections
6. Drowning, especially in fresh water
7. Unknown

C. Postrenal Failure
1. Sulfonamide crystals
2. Uric acid crystals
3. Stones
4. Ureteroceles
5. Trauma to a solitary kidney or its collecting system

(James, 1972, pp. 243-244)

The most common cause of acute renal failure in childhood and also the most rapidly reversible is poor renal prefusion due to hypovalemia (abnormally decrease volume of circulating fluid (plasma) in the body). This usually occurs following hemorrhage, albumin loss or extrecellular fluid loss or circulatory failure. It may lead to acute tubular necrosis (Blainey, 1972).

Renal venous thrombosis is a type of acute renal failure which occurs most commonly in the first two months of life. It is associated with asphyxia or dehydration. Because it is closely related to renal medullary necrosis, it is suggested that it may follow after the use of large doses of radiographic contrast materials in sick infants (Blainey, 1972).

Other forms of acute renal failure which occur in childhood are as follows:

Acute glomerulonephritis--rate in infancy, more important as a cause as childhood advances.

Obstructive uropathy--in childhood, this is nearly always due to congenital lesions, frequently concomitant with dysplarsia of the upper renal tract. The obligatory polyuria of this state may result in Na and H_2O depletion and aggravate the renal impairment.

Haemolytec - uraemic syndrome - frequently follows a gastrotestinal upset.

Chronic Renal Failure--is an end-result of damage to the kidney arising from many different causes. Although the majority of these are primarily diseases of the renal parenchyma, it is of the utmost importance to realize that obstructive lesions of the urinary tract can also lead to progressive renal failure. Some renal diseases are primarily glomerular, others start as a defect of tubular function, either congenital or acquired, but may eventually lead to glomerular failure. Despite the multiplicity of causes, the end-result is very similar since all lead to progressive loss of renal function and the development of the clinical state of "uremia" (Blainey, 1973). Its clinical features are also remarkably uniform, since usually renal failure is due to a deficiency of nephrons (DeWardener, 1973).

The causes of chronic renal failure are very numerous and we do not attempt to present a complete list of causes here. However, some of the causes identified are as follows:

Diseases affecting the glomeruli and vasculateire are the most common causes of chronic renal disease.

Developmental anomalies such as renal hypoplasia and dysplasia, cystic diseases of the kidneys, obstructive uropathy, especially posterior urethral valves in male infants, renovascular accidents, chronic or progressive glomerulonephritis, chronic urinary tract infections, metabolic disorders such as cystinosis and hyperoxaluria, hereditary renal disease including infantile nephrosis and Alport's syndrome (Blainey, 1973).

The clinical signs of chronic renal failure may be present with almost no symptoms and no obvious abnormalities on physical examination, or all the way to end-stage renal disease (Kronfield, 1974).

When symptome are evidenced, they may be in the form of high blood pressure, seizures, abnormal bleeding, etc. The disease is usually progressive even in the face of treatment. Permanent damage occurs even if the underlying disease is arrested.

DeWardener (1973) presents the following list of causes of chronic renal failure:

1. Destructive diseases due to Some Immunological Disturbance
   Glomerular nephritis
   Polyarteritis nodosa
   Disseminated lupus erythematosus
   Subacute bacterial endocarditis
   Anaphylactoid purpura
2. Infection
   Pyelonephritis
   Tuberculosis

3. Obstruction to the Urinary Tract

   Prostatic obstruction

   Bilateral calculi

   Urethral valves, etc.

4. Congenital Lesions

   Polycystic disease

   Tubular abnormalities (final stages)

5. Hypertension

   Malignant

   Non-malignant

6. Others

   Phenacetin nephropathy

   Amyloid

   Gout

   Diabetic nephropathy

   Hypercalcaemia

   Chronic intermittent haemoglobinuria: (i) sicle cell; (ii) nocturnal

   Renal vein thrombosis

   Myelomatosis

   Radiation damage

   Any other renal diseases which eventually destroy the nephrons, e.g., tubular changes associated with metallic cation loss (p. 181).

V. Life Functions

Health. Table 8 lists the problems the individual with kidney disease encounters in the area of personal health. In addition to the debilitating effects of the disease itself which may ultimately lead to death, the patient may also suffer from many symptoms and disorders related to treatment technologies and medications. Hemodialysis, for example, has been associated with an increase in body temperature while the blood is being cleansed and an increase in the white blood cell count, (usually temporary) (Merrill, 1965). Peripheral neuropathy is apparently connected to this treatment (Nose, 1969), as are fever and chills (Nose, 1969), and a variety of medical complications including infections, bone disease, changes in the pigmentation of the skin, myopathy (disease of the muscles), arthropathy (disease of the joints), and sexual impotence (Coles, 1974). Disturbances of balance have been recorded in patients with severe uremia who have dialyzed too fast and too long (Nose, 1969).

The use of steroids in the treatment of kidney disease involves many complications with regard to health. Tyler (1968) reports increased susceptibility to infections as a result of depressed responses of antibodies due to large doses of steroids. Patients subjected to steroid treatment may also manifest headaches, lethargy, weakness, vomiting and loss of appetite (Barnett & Edelmann, 1972) as well as acne, gastric ulcers, edema, and aseptic bone necrosis (Friedman, 1973; Morgan, 1972).

Other health problems associated with kidney disease are pain caused by kidney stones, accompanied at times by nausea and vomiting (Papper, 1971), gingival bleeding (Bailey, 1972), loss of appetite (Geschickter & Antonovych, 1971), pleuresy, progressive blindness (Hardwich & Lannigan, 1968), arterial calcification (Bailey, 1972), loss of hair, dry, scaly skin, (Bailey, 1972), and a variety of gastric disorders including indegestion, gas and irregular bowel movements (National Kidney Foundation, undated).

TABLE 5-8

LIFE FUNCTION TABLE - KIDNEY DISEASE: HEALTH

Statement of Problem	Dynamics	Source
Decreased aurical elasticity	Nephrotic syndrome - children.	H. L. Barnett & C.M. Edelmann, Jr., 1972
Diminished rates of hair and nail growth	-"-	-"-
High incidence of permanent teeth enamel hypoplasia	May be due to corticosteroid therapy	-"-
Transplant rejection	Rejection of 2nd or subsequent transplant more rapid and violent.	G. Williams, 1973
Arthritis	30% usually develop after first year of renal transplantation operation	Huskisson, E.C., & Hart, S.D.,
Electroencephalographic disturbance.	Renal failure - most patients with BUN above 60% mg.%	H.R. Tyler, 1968
Photic driving - unusual sensitivity to light stimuli.	More characteristic in patients with acute uremia in the recovery phase or following sudden diureses. Uncommon in patients with chronic uremia.	-"-
Hemorrhage (bleeding) tendency	Common complication of severe ayotemia. 1/3 - 1/2 patients with renal failure, 6% deaths in acute renal failure	M.B. Strauss & L.G. Welt (Eds.)
"Uremia amaurosis" - acute loss of vision.	Renal failure - develops over a few hours - occasionally more abruptly. Recovery may be within hours or days.	H.R. Ryler, 1968
Anorexia - loss or lack of appetite for food.	Acute glomerulonephritis	C.F. Geschickter & T.T. Antonovych, 1971
Somnolence - sleepiness	Acute glomerulonephtitis	-"-
Oliguira - diminished amount of urine compared to fluid intake.	Acute glomerulonephritis	-"-

Life Function Table - Kidney Disease: Health (contd)

Statement of Problem	Dynamics	Source
Symmetrical peripheral neuropathy	Complication of Furadantin (netrofurine) - treatment for renal infarction - both uremic and nonuremic patients.	H.R. Tyler, 1968
Neurologic complications	Arise from phenomena of transplant rejection.	-"-
Intractable vomiting Painful esophagitis Severe Headache Progressive blindness Pericardites Pleuresy	Untreated classic renal failure	J. Hardwick & R. Lannigan, 1968
Polyuric - passage of a large volume in a period. Nocturia - at night hypostheniuria (not concentrated).	Early progression of renal failure.	J.P. Merrill, 1965
Myoclonus and fasicular twitching	Renal failure	H.R. Tyler, 1968
Gastric disorders - Indigestion Gas Irregular bowel movements	Late stages of polycystic kidney disease	National Kidney Foundation
Increase in body temperature	Dialysis - 4-6 hrs.	J.P. Merrill, 1965
Decrease in WBC count	Dialysis - temporary May present a problem in cases with thrombocytopenia or leukopenia.	J.P. Merrill, 1965
Hypertension	Overhydration of dialysis patient, beginning of dialysis, end-stage renal disease.	Y. Nose, 1969; J. Hardwicks & R. Lannigan, 1968
Cardiac arrhythmias	Rapid shift in the serum potassium level in either direction by dialysis.	Y. Nose, 1969; J.P. Merrill, 1965
Sodium depletion - may lead to enough volume depletion to be associated with weakness and postural hypertension	Aggressive diuretic therapy especially with chlorothiayides	H.R. Tyler, 1968

Life Function Table - Kidney Disease: Health

Statement of Problem	Dynamics	Source
Skin color - bronze-tan hue, some a little green	Uremia - becomes more intense with sun exposure	G.L. Bailey, 1972; S.J. Kronfield, 1974; S. Papper, 1971.
Multiple ecchymoses - (extravasation of blood under the skin)	Uremia - subject to day-to-day minor trauma.	G.L. Bailey, 1972
Perspiration - uremic frost - sweat glands smaller	Chronic renal failure - sweat glands smaller in children and adults.	G.L. Bailey, 1972
Eye Problems - conjunctivae usually pale, retinal detachment,cataracts.	Uremia. Retinal detachment potentially reversible with dialysis and correction of volume and blood pressure.	G.L. Bailey, 1972
Problems with the nose - altered sense of smell, increased tendency for nosebleeds, small ulcerations, nasal membrances become pale - may become covered with a dirty-grey membrane.	Uremia	G.L. Bailey, 1972
Appearance of being chronically ill.	Patients with long-standing renal disease.	S.J. Kronfield, 1974
Prurites (itching) mild or so distressing overshadows all other manifestations.	Chronic renal failure. Sometimes disappears with more effective dialysis.	S. Papper, 1971; Y. Nose, 1969
Peripheral neuropathy	Hemodialysis	Y. Nose, 1969
Disequilibrium syndrome	Patient with severe uremia dialyzed too fast and too long.	Y. Nose, 1969
Rapid deterioration of CNS function.	Rapid reversion of blood chemical abnormalities - by medication - temporary and reversible.	H.R. Ryler, 1968
Seizures	Large doses of penicillin in patients with renal failure	H.R. Tyler, 1968
Petit mal seizure - focal or generalized.	Rare - renal failure.	-"-

Life Function Table - Kidney Disease: Health (contd.)

Statement of Problem	Dynamics	Source
Convulsions	Frequently precipitated by rapid lowering of blood pressure in patient with malignant hypertension.	H.R. Tyler, 1968
Increased susceptibility to infections	Antibody responses depressed by large doses of steroids or drugs.	-"-
Pneumonia associated with generalized systemic reaction	High proportion of patients taking immunosuppressive drugs	-"-
Masturbation - sexual arousal.	Nynephrology nurse's meeting - nurses from 17 out of 25 institutions represented gave evidence of relatively uncontrolled masturbation by male patients during hemodialysis.	N.B. Levy, H.S. Abraham, J.P. Kemple, F.P. Mc Kegney & B.H. Schribner, 1974.
Increasing size of kidneys cause waistline to increase, stomach becomes tender and swollen.	Polycystic kidney disease	National Kidney Foundation.
Arterial calcification	Frequent finding - more common in older patients - frequently encountered in teenagers. Uremia.	G.L. Bailey, 1972
Fever and chills	Hemodialysis	Y. Nose, 1969
Muscle wasting	Severe protracted uremia	G.L. Bailey, 1972; S.J. Kronfield, 1974.
Hair problems - dry, brittle, falls out, breaks easily, changed color, Some progress to partial baldness, loss of lunula.	Uremia	-"-
Nail changes - usually thin, brittle, often pitted or ridged, "Terry's nails", Muercke's lines".	Chronic renal failure	G. L. Bailey, 1972.
Skin condition - texture often altered, dry, scaly, somewhat loose, collagen fibers diffusely deranged.	Uremia - with good dialysis usually reversible	G.L. Bailey, 1972

Life Function Table - Kidney Disease: Health (contd.)

Statement of Problem	Dynamics	Source
Unilateral defective genital development	May occur in patients with unilateral agenesis.	S. Papper, 1971
Pain - severe pain often accompanied by nausea and vomiting.	Kidney stones - ranges from excruciating to only sense of awareness.	S. Papper, 1971
Hypotension	Ultrafiltration - hemodialysis	Y. Nose, 1969
Headache - may or may not be accompanied by nausea and vomiting.	Complication of hemodialysis. Sometimes evidence of the disequilibrium syndrome. Caused by alkaloses.	-"-
Gout Joint Complications Hyperparathyroidism Osteodystrophy - skeletal changes	Hemodialysis. Uric acid accumulation. Regresses with vigorous hemodialysis.	Y. Nose, 1969; S. Papper, 1971; G.L. Bailey, 1972; G. Williams, 1973
Newcastle Bone Disease	Common in patients on dialysis. Starts 6months to 4 years after start of dialysis.	Huskisson & Hart, p. 99
Vertebral collapse, rib fracture	High or prolonged steroid dosage before transplantation	J. Hamburger, J. Crosmer, J. Dormount & J.F. Bach, 1972.
Gastrointestinal bleeding	After dialysis	Y. Nose, 1969
Muscular disorders	Occur frequently in patients with mildly decompensated renal disease. Usually nocturnal. Tendency - recurrent and persistent until gradually occurs in waking hours.	H.R. Tyler, 1968.
Medical complications - Infections Uremia Pericarditis Peripheral neuropathy Bone disease Myopathy - disease of muscle Arthropathy - disease of joint Pigmentation Impotence Psychiatric	Regular hemodialysis	G.A. Coles, 1974

Life Function Table - Kidney Disease: Health (contd.)

Statement of Problem	Dynamics	Source
Metallic taste or salty taste	Recent onset of uremia, hemodialysis.	G.L. Bailey, 1972
Anemia - pallor weakness intolerance to cold dizziness	Chronic renal disease and renal insufficiency, polycystic kidney disease often occurs late in disease.	Y. Nose, 1969; Polycystic Kidney Disease - National Kidney Foundation, S.J. Kronfield, 1974.
Urinary frequency	Chronic renal disease and renal insufficiency	
Fatigue weakness easy fatigability lassitude	Chronic renal disease and renal insufficiency - should decrease with more frequent dialysis.	Y. Nose, 1969
Medical complications - Acne Aminoaciduria Aseptic bone necrosis Cataracts Bowel (colon perforation), Diabetes mellitus Edema Fatty liver Gastric ulcer Glaucoma Hypertension Hyperuricemia Myopathy Pancreatitis Panniculitis Papelledema Peptic (duodenal) ulcer Pseudotumor cerebre Psychosis Tumor dissemination Vasculitis	Most related to adrenocorticosteroid therapy	E.A. Friedman, 1973; J.M. Morgan, 1972
Gonadal dysfunction	Uremia - Serum testosterone levels rise to normal when male dialyzed for as long as a month.	G.L. Bailey, 1972
Gynecomaster - excessive development of the male mammary glands even to the functional state.	Develops in about 50% after 1 - 2 months adequate dialysis	-"-

Life Function Table - Kidney Disease: Health (contd.)

Statement of Problem	Problem	Source
Male infertility	Fertility returned shortly after transplant. Total azoosperma when treated by total body radiation	G.L. Bailey, 1972; J. Hamburger, J. Crosnear, J. Dormont, 1972; N.B. Levy, H.S. Abram, J.P Kemph et al., 1974
Hemorrhaging	Regional heperinization necessary to prevent when dialysis during menstrual flow	G.L. Bailey, 1972
Female - ceases to menstruate Male - loses desire and ability to sexually perform	Uremia; 3-6 months after transplant libido returns; 2-8 months menstruation returned	G.L. Bailey, 1972; W.A. Cramond, P.R. Knight, J.R. Lawrence, 1968; J. Hamburger, J. Crosnier, J. Dormont, J.F. Bach, 1972
Impotence	Common symptom - 24 out of 56 transplants; before uremia - 15% maintenance dialysis, 12% transplant recipients reported problem.	N.B. Levy, 1974
Cannula pain	Indication of infection, excessive use of cannulated limb impending clotting of the shunt.	Y. Nose, 1969; J.M. Morgan, 1972
Growth arrest	Transplantation and the prolonged use of steroids in high doses in children.	J. Hamburger, J. Crosner, J. Dormont & J.F. Bach, 1972; H.L. Barnett & C.M. Edelmann, 1972
Sleep disturbance	During dialysis	I.C. Menzies & W.K. Stewart, 1968; Y. Nose, 1969; R.J. Daly & C. Hassall, 1970.
Susceptibility to infections Proteinuria and edema may follow common upper respiratory tract infections.	Care should be taken to avoid exposure	H.L. Barnett & C.M. Edelmann, Jr., 1972;
Edema - face (*eyelids), hands, feet	Acute Glomerulonephritis	C.F. Geschickter & T.T. Antonovych, 1971.
Dyspnea	-"-	-"-

Life Function Table - Kidney Disease: Health (contd.)

Statement of Problem	Dynamics	Source
Headache Lethargy Weakness Vomiting Loss of appetite for food	Adrenocortical steroid therapy side-effects. Tapered off after many months when discontinued.	H.L. Barnett & C.M. Edelmann, Jr. 1972
Edema	Nephrotic syndrome	-"-
Sexual function worsening 35% in males, 24% in females, improvement in 9% of males, 6% of females.	Initiation and continuation of dialysis	N.B. Levy, 1974
Pregnancy - Flare-up infections in a solitary kidney indicate abortion connected with sterilization.	Should be postponed in patients with nephrotic syndrome. Most pregnancies abort spontaneously or are terminated - 3 successful pregnancies were reported.	D.E. Oken, 1972; J. Brod, 1973; P. Ackrill, F.J. Goodwin, E.P. Stratton et al., 1975
Impotency and sterility	Children on dialysis probably will be faced with sterility and impotency.	N.B. Levy, H.S. Abram, J.P. Kemph, et al., 1974
Facial abnormalities and renal agenesis (absence of)	Infants with renal agenesis have uniformity of appearance even of different races	E.L. Potter, 1972
Abnormalities of skin and subeutaneous tissue .	Infants with renal agenesis	E.L. Potter, 1972; S.J. Kronfield, 1974.
Abnormalities of Legs bowed legs and clubbed feet - fetal monster - fused legs and no feet.	Almost all infants with renal agenesis had bowed legs and clubbed feet.	E.L. Potter, 1972
Ear abnormalities	Infants with renal agenesis	E.L. Potter, 1972
Blood passed in urine	Polycystic kidney disease - usually lasts only a few days	Polycystic Kidney Disease - National Kidney Association.
Gastrointestinal changes - Colon: punctate ulcerations Segmental hemorrhagic enteritis diverticulosis	Uremia	G.L. Bailey, 1972

Life Functions Table - Kidney Disease: Health (contd.)

Statement of Problem	Dynamics	Source
Breath smells of ammonia or urine	Uremia	G.L. Bailey, 1972
Gingival bleeding, ulcerated mucose	Uremia - rapidly improves after institution of effective dialysis.	G.L. Bailey, 1972
Pulmonary changes - uremic pleuritis, uremic lung or pneumonitis.	Frequent in uremia	G.L. Bailey, 1972
Liver cysts	Developed by some patients polycystic kidney disease	Polycystic Kidney Disease - National Kidney Foundation
Pericarditis (inflammation of fibroserous sac surrounding the heart)	Clinically evident in about 45% of patients with renal failure.	G.L. Bailey, 1972; Y. Nose, 1969.
Hepatitis - both infectious and serum.	Significant complication with chronic renal diseases on chronic hemodialysis.	S.J. Hoyoshi, R. M. Nakamura, & E.A. Giorgi, 1971; Survey 5 major dialysis units - S. California; Y. Nose, 1969
Low back pain	Beginning of dialysis common in patients with severe hypertensive heart disease. Also when bank blood is used for priming - diappears within 5-10 minutes.	Y. Nose, 1969.

Social Attitudinal

As with any debilitating disease, psychological and sociological effects of kidney disease are myriad. Most of the problems listed in Table 5-9, however, are associated with dialysis and transplant operations rather than difficulties in adapting to the disease itself. The social restrictions resulting from the need to adhere to a strict diet and dialysis may lead to depression (Gordon , 1974) and a sense of isolation (Sweatman, et al., 1974). Some patients experience severe difficulties in adapting to the treatment and may manifest anxiety, depression (Gordon, 1974), negativism (Shultz, et al, 1974), fellings of helplessness, (Hamburger, et al., 1972; Bailey, 1972), and mild states of psychological shock resulting from the realization that life is dependent on unfamiliar, artificial means (Nose, 1969), and fear that the machine may fail (Baillod & Moorhead, 1974). In some patients, kidney transplants result in a disturbance of the body image, confusion of sexual identity (Cramond, et al., 1968), and guilt feelings or fear of dependency on the donor (Hamburger, et al., 1972).

Mobility

Table 5-9 lists some of the problems a person may experience as a result of kidney treatment and its treatment. While the patient must of course limit ambulation while on dialysis, kidney disease results in an overall constriction of activities due to mobility limitations.

TABLE 5-9

LIFE FUNCTION TABLE - KIDNEY DISEASE: SOCIAL-ATTITUDINAL

Statement of Problem	Dynamics	Source
Guilt feelings for donor	Prior to transplant - detailed psychological study 25 patients.	J. Hamburger, J. Crosner, J. Dormont & J.F. Bach, 1972.
Uncertainty about prognosis and anxiety about whether all aspects of care insure as favorable an outcome as possible.	Children with nephrotic syndrome - problem common to children with potentially fatal chronic illness.	H.L. Barnett & C.M. Edelmann, Jr. 1972
Controlled diet	Children - if they don't like it, won't eat it.	I.A. Horoshak, 1975
Difficulty of adaptation to center hemodialysis	Honeymoon Period - 1-3 weeks after first dialysis, lasted 6 weeks - 6 months. Period of Disenchantment and Discouragement - onset usually quite abrupt. Period of Long-Term Adaptation - slowly arrived at.	N.B. Levy, H.S. Abram & J.P. Kemph, 1974.
Stress of everyday life - normal methods of coping (eating, sex, tobacco) denied patient	Chronic renal failure	W.A. Cramond, P.R. Knight, J.R. Lawrence, et al., 1968.
Fear of failure of the artificial kidney machine - replaced by fear of failure of the transplant and loss of life style achieved away from dialysis.	Transplantation	A.J. Sweatman, R.A. Baillod & J.F. Moorhead, 1974
Psychological problems - anxiety, neurosis, fatigue, personality problems, family difficulties, problems of readaptation to work.	After transplant - relatively common - 22% of recipients.	J. Hamburger, J. Crosner, J. Dormont, & J.F. Bach, 1972
Misconception that disease is punishment for wrong doing.	Especially in younger children on dialysis.	J.A. Horoshak, 1975
Association of disease with genital organs and reproduction.	Development of distended abdomen in children.	-"-
Psychological cycles related to high acciden weekends.	Long term dialysis patients awaiting a transplant.	Levy, N.R.

Life Function Table - Kidney Disease: Social-Attitudinal (contd.)

Statement of Problem	Dynamics	Source
Depression - from persistent tiredness and lack of libido coupled with the tedium of routine dialysis, dependence on a machine for life.	Most common psychological manifestations of chronic dialysis. Severe depression usually subsides after first few weeks.	Wright, 1966; Y. Nose, 1969; A.J. Sweatmen, R.A. Baillod, & J.F. Moorehead, 1974; C.L. Hampers, et al., 1973; P.Gordon, 1974; A.J. Sweatman.
Sense of isolation	Solitude of dialysis	Sweatman, et al., 1974
Anxiety - caused by lack of confidence in equipment	Home dialysis and hospital dialysis.	-"- D. Block, 1972.
Maturing, development of appreciation of life	Approximately one year after transplant.	W.A. Cramond, P.R. Knight, J.R. Lawrence, B.A. Higgins, et al., 1968
Mood changes	Tend to be related to temporary physical problems and setbacks.	J.M. Morgan, 1972.
Social restrictions resulting from adherence to diet. Difficulties in eating out, loss of contact with friends at local pub.	Nearly all patients on dialysis.	J. Goodey & J. Kelly, 1967.
Great oral needs	Often takes the form of dietary and fluid indiscretion.	C.L. Hampers, et al. 1973.
Withdrawal	Frightened patient with a high level of anxiety on dialysis - children and adults.	-"- 1974
Irritability	Common with any significant degree of renal failure. Also as a result of inability to sleep during dialysis.	H.R. Tyler, 1968; P. Gordon, 1974
Demanding behavior which alienates hospital personnel	Patient with renal failure	H.R. Tyler, 1968
Negativism	Dialysis	M.T. Schultz, M.I. McVicar, J.P. Kemph, 1974.

Life Function Table - Kidney Disease: Social-Attitudinal (contd.)

Statement of Problem	Dynamics	Source
Aggressiveness	Dialysis	M.T. Schultz, et al., 1974
Anger	Dialysis	-"-
Intense disappointment, patient becomes upset	Develops if suitable work is not available when dialysis patient is ready for it.	I.C. Menzies & W.K. Stewart, 1968.
Child remains physically pre-adolescent. Teased by schoolmates. Use of denial.	Maintenance dialysis in children.	N.B. Levy, A.S. Abram, J.P. Kemph, F.P. Mc Kegney, & B.H. Scribner, 1974.
Poor cooperation of children on dialysis	Initially a problem until develop a relationship with staff.	J.A. Horoshak, 1975; N.B. Levy, et al., M.T. Schultz, M.I. McVicar & J.P. Kemph, 1974.
Dialysis treatment exaggerates a person's premorbid personality	Years of dialysis	N.B. Levy et al., 1973; I.C. Menzies et al., 1968
Disparity between wish and reality that dialysis will not cure. Disappointment, progressive giving up.	Impact after dialysis has been going on 6-9 months or a year.	N.B. Levy, et al.; J. Hamburger, J. Crosner, J. Dormont, J.F. Bach, 1972.
Psychological rejection of shunt as integral part	Some patients never accept shunt.	Reichsman, F., & Levy, N.B., 1974
Indifference to fellow patients.	Dialysis	N.B. Levy (21 male patients).
Problems posed by dietary restrictions (low protein diet) especially for "heavy eaters", "meat eaters".	Dialysis	R.G. Wright, P. Sand, & G. Levingston, 1966.
Critical stresses arising from factors such as job change or marital problems precipitated by condition.	After months of treatment	-"-
Sense of failure at being unable to have intercourse	Dialysis	J. Goodey, & J. Kelly, 1967

Life Function Table - Kidney Disease: Social-Attitudinal (contd.)

Statement of Problem	Dynamics	Source
Role reversal - condition often forces patient into certain amount of submissiveness.	Dialysis	C.L. Hampers, E. Schupak, E.G. Lowrie & J.M. Lazarus, 1973
Mutual hostility dependency Recipient has a gift for which he can never pay donor - has a need to overprotect his gift.	Community reinforces the sense of obligation on the part of the recipient to donor. Acute at anniversary time.	W.A. Cramond, P. R. Knight, J.R. Lawrence, B.A. Higgins, et al. 1968.
Disturbance to body image - transplantation	2-6 months to become accustomed. 2 years later all consciously protect site.	-"-
Fear of dependency on donor	Before transplant	J. Hamburger, et al., 1972.
Projection of parental guilt feelings on dialysed child.	Maintenance dialysis	C.L. Hampers, et al., 1973
Confusion of sexual identity	Arose when female donated to brother (case study)	W.A. Cramond, et al., 1968
Development of emotional symptoms reactive to stress	Dialysis	I.C. Menzies, & W.K. Stewart, 1968 (case study)
Depressive finality, hopelessness, no longer any element of independence.	Bilateral nephrectomy	G.L. Bailey, 1972
Anxiety	Suggestion of a graft-realization for the first time the true seriousness of condition (detailed psychological study).	J. Hamburger, J. Crosnier, J. Dormont & J.F. Balk., 1972
Difficulty with self-image	Dialysis	Levy (patient), 1974
Independency - dependency conflict.	Dialysis	Levy, 1974
Denial - of extent and functional impact of acute and chronic disease.	Dialysis	Wright, et al., 1966
Projection - see other patients as having more difficulty than themselves.	During dialysis treatment	-"-

Life Function Table - Kidney Disease: Social-Attitudinal (contd.)

Statement of Problem	Dynamics	Source
Mild state of psychologic shock - knows he must maintain life by unfamiliar artificial means.	Dialysis - initially	Y. Nose, 1969
Social difficulties arising from limitation on holidays.	Dialysis - limited as to how far can go from unit and how long can stay till must return for treatment.	P. Gordon, 1974
Adolescent psychological problems (rebellion against limited diet and other restrictions, long waits for donor kidney - discouragement, despair).	Dialysis	J.A. Horoshak, 1975
Emotional dependence on parents (older children resent this).	Long term dialysis	J.A. Horoshak, 1975
Suicide	Dialysis	G.L. Bailey, 1972
Inability to accept unnatural aspects of dialysis (extra corporeal circulation of blood)	Often found in patients with higher than average intelligence.	S. Sheldon, 1968.
Fear of death	Physician, dietician, complications enforce threat of death.	G.L. Bailey, 1972
Grief	Dialysis. Slow but gradual death of one's self.	-"-
Disruption of normal activities.	1 year after transplant majority of children with no preexisting personality problems or residual physical disability returned to normal life.	R.N. Fine, 1975, pop. of 109 aged 1-1/2 to 20, follow-up of 67, 1-7 years after transplant
Fear of intercourse	First attempts after transplant.	W.A. Cramond, P.R. Knight, J.R. Lawrence, et al. 1968.

Life Function Table - Kidney Disease: Social-Attitudinal (contd.)

Statement of Problem	Dynamics	Source
Emotional factors negatively influence sexual function	Dialysis	N.B. Levy, 1974
Concern about the effect of loss of libido on marriage partner.	Dialysis	C.L. Hampers, E. Schupak, E.G. Lowrie, et al. 1973.

TABLE 5-10

LIFE FUNCTION TABLE - KIDNEY DISEASE: MOBILITY

Statement of Problem	Dynamics	Source
Limitation on ambulation	During dialysis	S. Shaldon, 1968
Immobilization of limb due to installation of shunt.	Leg shunt - stay off both legs completely 2-3 days; 2 weeks immobilization with a splint. Progresses to walking with crutches - 6 weeks walking normally.	Y. Nose, 1969
Avoid excessive mobilization of cannulated limb, rapid motion of pronation and supination forceful flexior or extension of the wrist. Leg shunt - avoid excessive walking, running or jumping.	Life of cannula	Y. Nose, 1969
Shunt must be kept completely dry. Not able to swim.	As long as shunt used instead of needle technique	Cook, 1975
Avoidance of activities that might result in renal injury.	Unilateral agenesis should avoid such activities.	S. Papper, 1971
Interference with walking	21 patients with uremic polyneuritis - more than 1/2 had problem walking - not improved by dialysis; 4-8 months after transplant returned to normal - 1 patient significant persistent disorder.	J. Hamburger, J. Crosnier, J. Dormont, J.F. Bach, 1972.
Peripheral neuropathy - usually manifested in the senses but some patients develop paralysis of the extremitites.	Can be arrested or reversed by more vigorous hemodialysis. Sensory manifestations considerably improved after transplant in motor function extremely slow	Y. Nose, 1969

Cognitive Intellectual and Communication

As in the other life functions, several cognitive intellectual complications associated with kidney disease are side effects of treatment modes. Menzies & Stewart (1968) observe that some patients manifest intermittent delirious reactions during or just after dialysis; other patients with severe uremia who have been dialyzed too fast or too long may develop a disequilibrium syndrome which may ultimately progress to the point of seizures and episodes of mental confusion (Nose, 1969). Bailey (1972) notes that as uremia progresses, memory span and attention span may decrease. While very few restrictions were noted in the communication life function, Wright, et al., (1966) notes that some patients may have to learn to write with the unaccustomed hand due to placement of the cannula (See Tables 5-11 and 5-12.

TABLE 5-11

LIFE FUNCTION TABLE - KIDNEY DISEASE: COGNITIVE INTELLECTUAL

Statement of Problem	Dynamics	Source
Emotional and cognitive impairment - children.	Results from absenteeism from school	M. T. Schultz, M.I. McVicar, & J.P. Kemph, 1974
Intermittent delirious or subdelirious reactions, increased cerebral dysfunction.	During or just after dialysis often observed.	I.C. Menzies & W.K. Stewart, 1968
Memory span decreases Attention span shortens Less able to de "serial sevens" Develops great difficulty in performing simple integrative tasks.	Develop as clinical state in uremia worsens.	G.L. Bailey, 1972
Disequilibrium syndrome - may progress to the point of frank seizures and mental confusion.	Patient with severe uremia dialyzed too fast and too long.	Y. Nose, 1969.

TABLE 5-12

LIFE FUNCTION TABLE - KIDNEY DISEASE: COMMUNICATION

Statement of Problem	Dynamics	Source
Restricted use of cannulated arm.	Problem of affected extremity in the dominant side - must learn to write with other hand.	R.G. Wright, P. Sand & G. Livingston, 1966.

VI. Functioning as a Member of Society

The literature provides information about prevalence, incidence, mortality, and costs associated with kidney disease.

Functioning as a Member of the Labor Force

Of the civilians in the labor force who are prevented from working at their usual occupations due to kidney disease, not all are likely to be employed again when they become healthy (Hallan, et al., 1974). Companies hesitate to hire people with kidney disease because of the effect on insurance rates. Cooke (undated) reported that he does not turn in all of his medical bills to his company's insurance as that would raise the premiums for other employees.

In studies of earning capacity linked to employment, the Royal Free Study found that 20% of its patient group was earning less than before. Gordon's (1974) study showed a reduction in income for 39% of the patients. But more significant was the reduction in family income as a whole, which was found to be reduced in 56% of the families. This seemed to indicate that another member of the family was working less or had stopped work altogether because of the extra duties involved in caring for the family member with kidney disease.

The number of kidney disease patients employed is greatly influenced by welfare or third party payer requirements in various localities. For kidney disease patients undergoing dialysis in some states, the state law which requires patients to be unemployed in order to qualify for free hemodialysis discourages them from seeking employment even if they are able to do so. In some states the law restricts income to no more than $100 per month or there is a loss of welfare benefits. Therefore, many patients who would otherwise work part-time do not work at all (Levy, 1974).

Levy (1974) noted that some male patients go back to work and earn $5,000 a year while their necessary dialysis treatment costs $6,000 per year. Should the patient remain unemployed, the dialysis treatment will be paid for by the state, and he will receive approximately $300 per month in disability payments.

The employment record of well-dialysed home-dialysis patients is remarkably good, though many had to find new employment because dialysis has made them unsuited to their former work. This is common with occupations that involve heavy manual work or a lot of travelling. Other work-related problems suffered by patients who undergo home-dialysis are tiredness from lack of sleep or chronic anemia which may force them to work less hours or change to a less lucrative position in their place of employment (Sweatman, et al., 1974; Goodey & Kelley, 1967; Sadler & Sadler, 1970). Clotting and infection in cannulas is a major cause of loss of time from work by dialysis patients (Morgan, 1972).

A common characteristic of almost all kidney diseases is their tendency to progress eventually to a common end-stage, the clinical syndrome of uremia. Unlike most other chronic diseases, kidney diseases are particularly prone to cause death in patients in the middle and most productive years. This tendency brings out the fact that the social and economic impact of kidney diseases is far out of proportion to what could be expected from the usual analysis of the bare statistical data available (Goodman, 1969). Statistics completed by the National Health Survey and reported by National Kidney Foundation in 1965 reveal that the principal causes of workloss among American females are kidney-related diseases of the genitourinary system, and that the same diseases are the second highest cause of workloss in the United States today for the population under age 25. From age 25 on, these kidney-related diseases are the fourth highest cause of workloss. (U.S. Department of HEW, 1967).

A kidney disease patient's fitness for work varies with the type of disease suffered, the symptoms, and so on. Brod (1973) describes a number of kidney diseases in relation to the fitness for work of the patient suffering from the disease:

1. Renal Tuberculosis--A patient with active renal tuberculosis is unfit for work and belongs in a tuberculosis department sanatorium. If the results of treatment are satisfactory and the patient can be regarded as clinically cured, 6 to 9 months after successful nephrectomy or at the end of one year of conservative treatment, he can be allowed to return to a light employment in suitable surroundings, where he has the possibility of keeping to the rules for the regimen of a tuberculosis patient.

2. Acute Glomerulonephritis--Requires strict bed rest and the patient is unfit for work. The bed rest extends into the stage of residual changes, as long as signs of disease activity are present. When the signs of the disease have fully disappeared or when only slight residues are left without signs of a more marked disease activity and when the renal function has recovered, the patient can, following a suitable period of convalescence, return to an occupation, which at first should be light. If more serious residual changes are present or if renal function is reduced even without marked signs of disease activity, it is not advisable to allow the patient to do heavy physical work.

3. Chronic Glomerulonephritis--In its latent stage, patients are treated by bed rest only during an acute exacerbation or if for some reason the disease starts to progress precipitously. Every slightest infection requires bed rest and intense antibiotic treatment. The work load must be adapted to a restricted condition of health. Occupation should be sedentary and near a place where the patient can keep his diet. He should not be exposed to unfavorable weather conditions and to an increased

risk of infection. To raise his resistance against infection, he should daily wash his whole body with tepid water and should take daily walks in fresh air and observe hygienic life habits. When chronic glomerulonephritis is far progressed, the patient must rest at mid-day. As the disease approaches chronic renal failure, it leads to fatigue and the patient can usually be only employed for a few hours per day.

4. Pyelonephritis--The Chronic focus of infection and the diminished feeling of health associated with phyelonephritis reduce the patient's working ability. Even if the process is arrested, pyelonephritis makes him unfit for heavy physical work because renal functioning usually remains deficient. Nothing indicates that lighter work and especially a sitting occupation could have any unfavorable effect on the course of the disease. These types of work would be suitable for the patient unless the renal function has been reduced to a level at which the homeostasis of the milieu interior is threatened or unless grave complications of severe hypertension are present. When choosing a new occupation, due care should be taken that the patient is not exposed to an unnecessary risk of infection, that he can adhere to his dietary regimen and that he has the possibility of a break in the course of his working hours. Consequently a position that permits a divided working day is advantageous.

5. Renal Diabetes--Fitness to work is usually unrestricted. The only exception is for individuals with a tendency to hypoglycemia, who should avoid heavy physical work and also occupations where hypolgycemia may lead to injury (driving, working on building platforms, etc.).

6. Kidney Stones--The patient is normally unfit for work during colic attacks associated with kidney stones. If the stone is wedged and obstructs the free outflow of urine, the patient, while waiting, can be allowed to work, but must remain under constant supervision because

of the danger of infection, impairment of renal function, and the development of hydronephrosis. The fitness for work of patients with immobile stones likewise depends on the presence of a concomitant infection and the degree of renal injury. If these complications are absent, the patient is fit for work but requires regular medical supervision.

7. Adenocarcinoma of the Kidneys--Patients with adenocarcinoma are naturally unfit for work until the tumor has been removed. This condition includes Hypernephroma and Grawitz Tumour also.

8. Acute Renal Failure--As long as the renal function is abolished or severely impaired, the patient is unfit for work. The same is true for many workers following the re-establishment of the urine flow. Duration of convalescence depends on the severity of the precipitating cause or the duration of the oliguric stage and on the general condition of the patient. Only after many months and repeated controls of renal function is a definite evaluation of the patient's working ability possible. After a nephrotoxic lesion, a full recovery of working ability is the rule, as is true in the majority of cases with an ischaemic injury.

9. Congenital Sponge Kidney--This condition does not restrict the patient's ability to work. Because of the tendency to stone formation, work in hot surroundings involving much sweating is best avoided.

10. Polycystic Kidneys--The great weight of the kidneys, which often gives the patient great trouble, especially in certain positions, is an obstacle to some types of employment--for example, those which entail standing or walking for long periods of time or heavy physical labor. As long as renal function is normal and there are no signs of infection, these mechanical difficulties are the main obstacles to complete fitness

for work. A reduction of renal function lowers fitness for work, and in cases of hypertensive disease or infection associated with polycystic kidneys, the rules of fitness for pyelonephritis and hypertensive diseases are followed.

A number of studies have been conducted on the rehabilitation of kidney disease patients. Strauss and Welt (1971) reported that Vocational Rehabilitation financially supports restoration of patients to the labor force. Funds are available to applicants within budgetary restraints, and the benefits cease 6 months after the successfully rehabilitated patient has obtained employment.

The University of Alabama conducted a study which assessed the rehabilitation potential and problems associated with the highly artificial life of a patient on dialysis. All but 2 of the 16 patients studied (87%) were able to maintain a satisfactory level of rehabilitation as judged by performance as homemaker and mother or ability to hold a job providing satisfactory personal or family support. Almost all of the clients responding to the study returned to the same occupation that they held prior to dialysis (Morgan, 1973).

The Gottschalk Report assessed the rehabilitation experience of 79 patients over a 12-month period. Seventy-one percent restored to full activity, 18% to partial activity, 6% to restricted activity and 5% to no activity (Table below). As many as three-quarters of the dialysis patients were found to be able to continue to work and lead fairly normal lives for several years. Other dialysis patients are fortunate to have successful transplants and to achieve what appears to be a "cure" for their disease with a high level of rehabilitation that lasts several years (Gottschalk, 1967).

TABLE 5-13

REHABILITATION OF DIALYSIS PATIENTS

		ACTIVITY			
Center	No. of Patients	Full[1]	Partial[2]	Restricted[3]	None[4]
1	26	19(73)	6(23)	1(4)	1(10)
2	10	9(90)	----------	----------	----------
3	15	10(67)	3(20)	----------	2(13)
4	8	2(25)	3(38)	3(37)	----------
5	16	14(88)	----------	1(6)	1(6)
6	4	2(50)	2(50)	----------	----------
TOTALS	79	56(71)	14(18)	5(6)	4(5)

1 40 hours or more of work per week; or full household chores; or full-time student.

2 25-39 hours of work per week; or light housework; or part-time student.

3 5-24 hours of work per week.

4 Unable to work, do light housework, or attend classes.

Note: Numbers if parentheses are per cent of patients rehabilitated.

Source: Gottschalk, 1967

Functioning as a Member of the Community

The kidney disease patient undergoing hemodialysis frequently suffers from loss of membership in groups within the community. Withdrawal from bowling and athletic teams, withdrawal for social club membership, resignation from elected or officer positions in a given organization or business and a general lack of participation in affairs of the community are some self-imposed limitations of kidney disease patients. In some cases, lack of involvement in the community is caused by having to move across state or country for dialysis treatment (Wright et al., 1966).

Patients who have received kidney transplants are usually fully restored to health in a period of time ranging from weeks to six or ten months after the transplant and therefore, in most cases, there is no problem about their return to normal activity within the community and in their social and professional lives. This social and professional rehabilitation is not so easily achieved if there has been a very long period of invalidism before the transplant. If the patient is skilled in some trade or profession it is a little easier.

Atkins et al. (1971), states that maintenance hemodialysis has permitted full rehabilitation to productive living in better than 80% of patients. They note that the average adult with normal motivation and emotional stability has better than a 90% chance of leading a reasonably normal life on maintenance hemodialysis.

In an experiment conducted at a unit of the West Haven Veteran's Administration Hospital and reported by Foster et al., (1974), the psychosocial aspects of kidney disease and survival factors associated with dialysis were studied. The report of this experiment described the self-imposed social "constraint" in the renal dialysis group as reflecting Lifton's concepts developed through investigations of survivors of Hiroshima and concentration camps. Both chronic dialysis patients and survivors of holocausts share:

1. An immersion into death which leaves a "death imprint."
2. Guilt over "survival priority."
3. Psychic numbing - a cessation of feeling.
4. A disruption of interpersonal relationships because of the individual's fear of "counterfeit nurturance."
5. Disruption of interpersonal relationships because of other's "fear of contagion."
6. "Impaired formulation" of their relations with the deceased leading to incomplete mourning. This is intensified in the renal unit because the deceased often lived considerable distance away and fellow patients were unable to attend their funerals.

Functioning as a Member of the Family

In a personal interview with Cooke (undated) he stated that it is common for relatives of a kidney disease patient who needs a transplant to withdraw from the patient because they do not want to be the donor of the kidney.

In an experiment conducted on 11 families with children where one family member was receiving dialysis treatment, all said that the children knew about the illness and according to age, understood some of the implications. Six of the families felt the children experienced varying degrees of anxiety and strain. One family reported that the children would not go to sleep until their father returned from the hospital after dialysis. In another family where it was known that the father could become ill and even die, the children were afraid of the ambulance. In another family, the wife reported that she had more responsibility in disciplining the children since their father was on dialysis. Two of the families said that their family structure was unaffected (Goodey, 1967).

Wright et al. (1966) reported on interview material which suggested a discrepancy between the early expectations of dialysis by relatives and the current functional status of the patient. The patient's family usually expected a higher level of well being. A majority of patients and spouses emphasized the unpredictability of feeling well, which leads to considerable difficulty in planning or attending various social commitments for the patient or his family. Patients tend to feel guilt (unless secondary gains are associated with breaking engagements), while spouses have to suppress hostility and frustration with statements such as, "He just doesn't feel well enough to go" (Wright et al., 1966).

The patient undergoing hemodialysis sometimes experiences a decrease in or a total loss of sexual potency. Changes in body image of the patient, weight loss, presence of cannulae, leg braces, and bone and joint pain have led to decreased sexual desire in some spouses of kidney disease patients (Wright et al., 1966).

The family relations of home dialysis patients sometimes deteriorate due to such problems as the allocation of one room solely to dialysis, leading to crowding and tension within the family (Sweatman et al., 1974).

If a relative is responsible for dialysis, this sometimes leads to stress and conflict if things go wrong. If the patient is primarily responsible for his own dialysis, he cannot blame the relative for technical mishaps. This simple fact, plus the resentment engendered by long-term dependence upon a relative, points to the necessity of enlarging the independent approach to self-treatment in the home. The only exceptions would be where children are the patients, but even in these cases the patient could be encouraged to assume as much responsibility as possible (Shaldon, 1968).

Dialysis in the home can lead to changes in the family structure. The patient on maintenance hemodialysis and his/her family undergo a series of psychological stresses and problems which are inherent in the use of this complicated, demanding and expensive treatment. Maintenance hemodialysis magnifies whatever basic emotional problems the patient might have and causes its own stressful and debilitating features (i.e., recurrent cannula failure, chronic fatigue after each hemodialysis, lack of stamina, insomnia, continued self-discipline demanded by the strict diet and care of the cannulas. In the study conducted by Bailey (1972), it was found that approximately 5% of the home dialysis population demonstrated a parent-child relationship between patient and spouse dialyzer. In rare cases, the patient was actually found to act like the parent but almost always the patient became passive and child dependent. Other relationships were described as Master-Slave where the patient is husband-master and the wife-dialyzer is the slave. In these instances, the husband tends to demonstrate almost juvenile combinations of denial, shirking of responsibilities, anger, etc. The wife may also demonstrate anger at the patient's refusal to take part in his treatment. Psychiatric help is usually helpful in developing self-assurance in the wife but is rarely able to change the patient's attitude. The Obsessive-Compulsive relationship is such that when a patient, especially when paired with the same type of spouse, is quite capable of achieving prolonged, excellent performance. As in other pahses of everyday life, the patient is capable of deciding that this is necessary to maintain life. It has been mastered by others, therefore he will learn and perform well. These individuals seem quite capable of acknowledging their spouse-dialyzer as a necessary extension of the machine at the time of dialysis, and exercise the ability to "turn the spouse on" as a machine part. Other than during the dialysis period, their relationship may be normal (Bailey, 1972, p. 436).

VII. Technologies

A. Transplant

There is no doubt that the patient with a successful renal transplant feels better and has fewer clinical problems than the patient maintained by periodic hemodialysis. If the transplant is successful, the patient is able to lead a relatively unrestricted life with a healthy sense of well-being (Kiser & Kolff, 1967). Early attempts to transplant kidneys from one human to another by well-coordinated teams of internists, surgeons and urologists began with attempts of French workers in the late 1940's and in the United States with the studies by Hume, Merrell and their colleagues in the early 1950's. At that time, kidney donors were cadavers (in some cases, the French team used kidneys from freshly guillotined prisoners) (Merrill, 1974).

As of July 1, 1970, the ACS/NIH Organ Transplant Registry has recorded 4,320 kidney transplantations performed throughout the world on 4,050 patients. Of these, 2,108 were transplanted from living donors (53 from identical twin, 761 from siblings, 923 from parents, and 371 from others). 2,212 cadaver kidneys were used (Hamburger, 1972). A 1973 report by NIH reported 5,127 kidney grafts performed by 112 institutions in the United States prior to January 1, 1972, and 8,332 cases worldwide from 204 institutions (U.S. Department of HEW, 1973). The National Kidney Foundation has the following figures as of October 1975 for transplantations: 3,752 - worldwide, and 2,000-2,500 in the United States. During the year 1975, up to October, 1,500 transplants had been performed in the U.S. (Spitz, 1975).

There are a number of problems associated with kidney transplants, one of which is the cost involved. Gottschalk (1967) estimated that at least 6,300-8,500 new "ideal candidates" would enter the patient pool in 1970. Of these, approximately 750 would have transplant operations and

1,400 would begin chronic dialysis. The remaining 4,000-6,300 of the ideal candidates, would be left to die because of insufficient funds (Atkins, 1971). If a transplant is successful, it is estimated that the patient will require $1,000-2,000 per year for life. The transplant itself, not including preceeding dialysis, may cost from $10,000-25,000 depending on the course of the patient's recovery (Wilkins, 1972). In most cases, tissue typing and organ procurement costs have been supported by federal funds. The position of the Public Health Service (PHS), which has provided much of the needed support, is that the support for organ procurement is for demonstration purposes only and project grants include the stipulation that the organization develop a program to assure continued sources of funding once the grant ends. In 1971, these organ procurement activities were at a crossroads. The logical source of continued funding appeared to be through the recipient's private health insurance and some insurance companies were willing to pay on conditions that the charge appeared on the recipient's hospital bill (Wilkins, 1972).

The current medical requirements for transplant patients are that they must suffer from terminal renal insufficiency that is irreversible, requiring hemodialysis to maintain life (Kiser & Kolff, 1967). A major problem in transplantation is rejection of the graft. Agents used to minimize the rejection response: Immunosuppress therapy and drugs such as azathiprine, prednisone, antilymphocyte, globulin, cyclophosphamine and occasionally local x-irradiation of the kidney (Merrill, 1974). Other complications or technical problems associated with transplants are rupture of the anastomosis or the ureter; bone disease, particularly aseptic necorsis of the hip; continuing and possibly accelerated vascular disease; acute ischemic nephropathy; recurrent glomerulonephritis; and infections which the immunoauppressive therapy predisposes the patient to. The incidence of spontaneous carcinoma, particularly of the lymphoid system, is also markedly increased in patients on immunosuppressive therapy (Merrill, 1974). Bryan (1975) reports that 1972 data showed only 37% of over 3,000 potential transplant patients obtained cadaver kidneys. This is due to the lack of donated kidneys; most cadaver kidneys are accident victims. The rejection rates for transplants are 50%; for family donors 30% (Horoshak, 1975). General benefits to individual patients with renal transplants are:

correction of anemia;
fuller recovery of libido;
fertility and possible pregnancy;
freedom from restriction of diet and fluids;
greater social freedom. (Sweatman, Baillod & Moorhead, 1974).

The literature cites other psychological, legal, and moral problems involved in transplantation, and it questions whether attempts to prolong life by such unproved, seemingly heroic procedures using borrowed human organs is morally or ethically justified (Kiser & Kolff, 1967). In response to the moral question, J. P. Merrill defined the guidelines for future endeavours in replacement surgery as follows. "Policy in the field of organ transplantation must be governed not only by the moral and ethical principles delineated, which apply to many fields of medical endeavor, but by prolonged experience of a well-motivated scientific team with a plan to obtain maximum information supplemented by a broadly based supporting laboratory program. A constant concern not only for the healthy donor, but for the dignity of the dying patient as well as for the future of this form of therapy is involved."

B. Dialysis

Each year 40 persons out of one million population begin maintenance hemodialysis (Kronfield, 1974). In 1973, about 3,300 patients with irreversible kidney failure were being kept alive by repeated hemodialysis. The number of patients judged medically and psychologically suited for this type of demanding long-term treatment is 7,500 (U.S. Department of HEW, 1973). Maintenance hemodialysis basically takes two forms: Center dialysis and home dialysis. The important difference between these two forms of dialysis is the difference in costs involved Center dialysis costs from $15-$20,000 and Home dialysis costs $5-$6,000 plus the cost of instruction of patient and family (Atkins, 1971). The excessive cost of dialysis is indeed a limiting factor in treatment by chronic dialysis (Strauss & Welt, 1971). Recent developments in technology suggest that a portable dialysis unit may be available in the near future which would reduce costs and interference with daily activities.

Whelpton (1974) describes three technical aspects of hemodialysis as:

1. Technical aspects of supporting the present treatment systems, especially the home-dialysis service.

2. Development of present equipment and of treatment methods, including means of controlling and evaluation machine performance.

3. The study of the mechanisms by which the present systems function and the development of totally new methods of treatment (NKF, undated).

The most commonly used dialyzers are:

1. The coil version.

2. Membrane-layered, parallel flow.

Hemodialysis is used in cases of chronic renal failure and progressive renal insufficiency causing permanent loss of function. It requires paracentesis and facilities for infusion and drainage of dialysis fluid.

Peritoneal dialysis is used in cases of acute renal failure, particularly in the treatment of children suffering from renal failure. It requires the formation of a shunt between the radial artery and vein, with the insertion of plastic tubing to provide access to the circulation. With repeated dialysis, heparinization (treatment with heparin to increase blood clotting time) is used (Geschickter & Antonovych, 1971).

In deciding who can benefit from dialysis, the doctor must differentiate between prolonging life and prolonging death. If there is any doubt, the patient should be given a trial on dialysis. In answer to the question, "How long is life expectancy with dialysis treatment?", Hull (1975) notes that since nephrologists have only been doing chronic dialysis for 13 or so years, their experience is limited to people continuing over 10-12 years. Recent reports indicated that the cause of death in dialysis after the first six months tends to relate heavily to cardiovascular problems, which is one area in which dialysis needs to be observed and supported (Hull, 1975).

At the Sixth Annual Conference of the National Institute of Arthritis, Metabolism and Digestive Diseases, causes of mortality of dialysis patients were reported. The principal causes of death were reported as heart diseases, cerebrovascular diseases, other vascular complications and infections (61% of deaths). Other causes were equally divided between respiratory diseases, kidney diseases and uremia, endocrine and metabolic diseases, complications of treatment and accidental death, diseases of the digestive system and liver and miscellaneous other causes.

Hemodialysis is essential during the period before renal transplantation. Without it, successful transplantation would not be possible. On dialysis, the patient can be sustained for an unlimited period of time (Merrill, 1965). Merrill states that, "Each year more than 400 children with end-stage renal disease throughout the U.S. are put on hemodialysis to await a transplant." The period of time per week which a patient spends on dialysis is three to five hours at a time, three times a week (Horoshal, 1975; Cooke, personal communication).

In Texas, dialysis was not possible until 1973, when centers opened in Houston, San Antonio, El Paso, Lubbock and other cities throughout Texas. Patients were accepted on the basis of need as facilities did not exist to treat all patients. Today, more patients are treated and the expertise, as well as the number of centers, has increased in Texas. Forty-three centers in Texas now have facilities for chronic and acute dialyzing as well as home training (Hull, 1975).

C. Other Technologies

1. Clinical Lab Tests. The most commonly employed blood test for the detection and evaluation of renal function is the blood urea nitrogen determination test. Blood urea nitrogen is influenced by diet and catabolism as well as of renal impairment. Another reasonably simple and reliable test is the serum creatinine concentration test which is dependent on only the muscle mass and glomerular filtration rate of the patient (Atkins, 1971). In order to measure the adequacy of dialysis, the motor nerve conduction velocity is considered more relevant than the BUN, but variations in measurement are currently too imprecise. Recent studies supported by the Artificial Kidney-Chronic Uremia Program on the EEF and Continuous Performance Test indicate that these may be repeatable, quantifiable, sensitive, objective, relevant measures of adequacy (Donshik & Krueger, 1971).

2. Detoxification of uremic patients by method of selective absorption of uremic toxins with special sorbents.

3. Introduction of selective sorbents into the dialysis bath of artificial kidneys to bind uremic toxins irreversibly as they cross the membrane.

4. Introduction of selective sorbents for urea and uremic toxins di-

rectly into the gastro-intestinal tract (Donshik & Krueger, 1971, p. 2-7).

Bioassay - a diabological function (at the organ, tissue, cellular, or molecular level) is correlated with the presence of a substance; the degree of function is correlated with the amount of substance present. In behavioral bioassays in uremia, rats of monkeys are experimentally made uremic, performance on a learning task is measured and decreases in performance are correlated with severity of uremia (Donshik & Krueger, 1971).

5. Artificial Kidney - this machine is based on the principle of dialysis. It has the ability to remove or add substances to the blood. It is used when the kidneys suddenly cease to function as a result of disease, acute kidney failure or injury. An artificial kidney is used when chronic kidney failure progressively destroys the kidneys over a period of years. Many drugs or chemicals are normally removed from the body (excreted) by the kidneys, and when the kidneys do not function properly these agents, maintained in the body, may cause poisoning. When a person takes an overdose of a substance either accidentally or purposely, permanent damage may be caused to the brain, liver, and other vital organs if the kidneys cannot remove the chemical quickly enough. The artificial kidney can relieve the overload on the patient's kidneys and can remove poisons rapidly before permanent damage occurs (U.S. Department of HEW, 1967).

A number of specialized diagnostic procedures are used in investigating renal disease:

cystoscopy

intravenous pylelography

percutaneous renal biopsy (Geschickter & Antonovych, 1971).

Techniques used in investigation of the blood vessels of the kidney:

India ink

Neophrene injection plus corrosion of kidney substance with a concentration of HCl

Methods of study of the injection materials:

Paraffin

Celloidin

Microdissection

Fluorescent techniques

Electron microscopy (Fourman & Moffat, 1971).

Renal Biopsy - patients who profit most from this technique are those with proteinuria, the nephritic syndrome, abnormal renal function from unknown cause, or who have evidence of a "collagen disorder," renal inflammation or infection (Williams, 1973).

Treatment technologies of renal disease:

Treatment of early pyelonephritis	- antibiotics
Kidney failure	- transplantation and dialysis
Certain types of nephrisis	- steroid hormone drugs
Anatomic birth defects	
Eliminate obstructions	- surgery
Kidney stones	- surgery, diet (U.S. Department of HEW, 1973)
Nephrotic Syndrome	- adrenocortical steroids - immunosuppresant - cytoxic drugs - diuretics - antigiotics (Barnett & Edelmann, 1972)
Renal Cell carcinoma	- surgery - radiotherapy - chemotherapy (Lokich & Harrison, 1975)
Renal artery hypertension	- surgery - diet - drugs - antihypertensives including diuretics, blockers or syoepathetic outflow or activity and direct smooth muscle vasodilators (Kirkendall, 1975).

Therapuetic Agents in Renal Disease - diuretic-antohypertensive agents
- antihypertensive agents anti-infectious agents anti-inflammatory and immunosuppressant agents. Regulators of acid-base equilibrium. Relaxation therapy - to help patients find a more effective and less harmful relief of tension.

Tests of Renal Structural Integrity - Clinical examination of the abdomen. Straight X-ray of the abdomen. Intravenous pyelography. Renal tomogram. Renal Scintegram. Retrograde Phelography. Renal Arteriogram. Isotope Renogram. Renal Biopsy.

Atkins, Leonard & Scribner (1971); Black (1972); Fourman & Moffat (1971); Geschickter & Antonovych (1971); deWardener (1973); Morgan (1973); Cramond, Lawrence & Higgins (1968); Kluthe, Berlyne & Burton (1972); Kirkendall (1975); Lokich & Harrison (1975); Barnett & Edelmann (1972); U.S. Department of HEW (1973).

Predictions

In the United States, there are currently 5,000 patients on dialysis. Dr. Scribner of the National Kidney Foundation predicts that the dialysis population of the U.S. will stabilize somewhere around 20,000 patients no matter what happens to the success or failure of renal transplantations (Levy et al., 1974). Change in rehabilitation of chronic renal failure is likely to take the following forms:

1) Lower cost modes of dialysis treatment by such methods as home or self-care dialysis Center treatments.

2) More adequately supported renal transplantation (Bryan, personal communication).

Other predictions on the future of hemodialysis are as follows:

1) Low-cost disposable equipment

2) Simplification of dialysis delivery system

3) New and improved dialyzers

4) Filtration units

5) Wearable artificial units.

VIII. Service Delivery

Dialysis - Hospital Hemodialysis - chronic units
acute dialysis

Satellite Units - limited care dialysis (storefront)

Home Dialysis - home training units
self-care dialysis (patients and family dialyze - legal problems) (Sweatman et al., 1974; Hull, 1975).

Current information as of July, 1971, available by state:

- State Health Department address
- Kidney Disease Voluntary Agencies
- Health Program Planning
- Bacteriuria screening programs
- Chronic dialysis facilities
- Limited Care Facilities
- Kidney Transplantation Facilities
- Tissue typing laboratories
- Financial Assistance (formerly Medicaid Program) Title XIX
- Vocational Rehabilitation Program
- Voluntary Agencies and Private Foundations
- Crippled Children's Bureau

Other sources:

- State Legislation
- Anatomical Gifts of Legislation
- Yearly Mortality

Goodman (1969) gives information by state on:

State Health Department address

Kidney disease advisory and study groups

Kidney disease voluntary agencies

Kidney disease commission of state medical society

Health Program Planning Groups

Facilities for Specialized Training

Progressional Education

Public Education

Kidney disease screening programs

Kidney disease research projects and special studies

Chronic dialysis facilities

Acute dialysis facilities

Kidney transplantation facilities

Tissue typing laboratories

Financial assistance

Legislation Statistical data - mortality

Genetic counseling services are run by University medical schools in 45 American and Canadian Centers affiliated with the National Genetics Foundation in New York City. The Foundation also maintains free telephone services and will refer people for genetic counseling. The Training Program for Home Dialysis: Ten Commandments for teaching the home dialysis patient encompasses the following teaching goals:

1. to understand his disease
2. to understand the treatment and its effects
3. to be realistic and comfortabel (encourage him)
4. to achieve the optimum in self-care
5. to adhere to his diet conscientiously
6. to control his body weight

7. To control his blood pressure
8. to interpret routine laboratory tests
9. to care for the cannulas properly
10. to perform a proper and safe hemodialysis or peritoneal dialysis (Nose, 1969; Wilkins, 1972).

Mobile dialysis unit--for several years an international agreement existed whereby patients were able to take holidays near renal units. However, this agreement was discontinued due to concern for the spread of viral hepatitis. Currently, only patients from a specific dialysis unit can use the facilities of a mobile dialysis unit in order to reduce the problems of cross infection. The mobile unit is sometimes an old ambulance with a bed for the patient and the person who stays with him. This vehicle can double as an emergency vehicle when patient's home unit is not completed or if accidents make the home unit inoperable (Blache, Anderson & Cattell, 1974).

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CHAPTER 6
DISABILITY ANALYSIS: DIABETES

Introduction

Diabetes mellitus is a chronic disease that is found all over the world and presents a serious and widespread health problem. The oldest known medical document, an Egyptian papyrus of 1500 B.C., contains the earliest reference to what was probably diabetes. The disease was first described by Celsus (approximately 30 B.C. - 50 A.D.) and named by a Roman physician, Aretaeus of Cappadocia, about 60 A.D. (Lockwood, 1952).

Diabetes mellitus is unique among chronic and incurable diseases. This uniqueness includes the frequently asymptomatic character of the disease in its early years; the necessity for dietary restriction, oral drug usage or insulin injections and daily urinalysis as part of the scheme of control; and the possibility of complications and the anxiety associated with this knowledge. Further, the patient is more actively responsible for the control, not cure, of his disease than is ordinarily the case in chronic illness (Treuting, 1962).

I. Definition

Diabetes mellitus is a complex disorder which not only affects the body's ability to metabolize carbohydrates but also interferes with the breakdown of fats and proteins.

Diabetes mellitus results when the pancreas fails to produce an adequate supply of insulin or, in some cases, no insulin at all. Insulin is a hormone which regulates the use and storage of glucose--glucose being an end product of carbohydrate metabolism. Therefore, if the pancreas does not secrete enough insulin to turn these foods into energy, or to store them for future use, there will be an increase in the levels of glucose (sugar) in the body and the excretion of this sugar in the urine. This continued loss of carbohydrates eventually causes diabetes, as well as malfunctioning of the other metabolic processes and various systems in the body (i.e., kidneys).

There are two forms of diabetes: juvenile and adult. In juvenile diabetes, the onset of the disease occurs during the growing years (0-15 years), with diabetic individuals being insulin dependent and prone to ketosis (the excessive formation of ketones). Juvenile diabetics exhibit the following:

1. the diabetic triad--polydipsia (excessive thirst), polyuria (excessive urination), and polyphagia (excessive hunger).
2. sensitivity to insulin treatment and instability of blood glucose levels in response to insulin.
3. a tendency to remission.
4. within the first five years, a disappearance of all insulin with the body (Danowski, 1971).

In adult diabetes, the disease occurs during middle age, with diabetic individuals being relatively insensitive to insulin and resistant to ketosis. Adult diabetics exhibit the following:

1. a gradual onset of the diseases.
2. stability of blood glucose levels can be achieved.
3. only occasional remission.
4. high degree of responsiveness to oral anti-diabetic compounds.

The two forms are further compared in Table 6-1.

TABLE 6-1
JUVENILE DIABETES VS. MATURE DIABETES

	Growth-onset	Maturity-onset
Age	Usually children and young adults	Middle-aged and elderly
Sex	Male = Female	Male < Female
Onset	Acute or subacute	Gradual
Symptoms	Present	May be absent
Nutrition	Normal	Often obese
Weight loss	Marked	Often absent
Ketosis and coma	Common	Absent or slight
Response to insulin	Sensitive	Relatively insensitive
Plasma insulin	Absent or low	Normal or reduced
Response to oral agents	Absent	Present

Source: Oakley, 1973, p. 55.

The importance of recognizing these two types of diabetic disorders lies in the fact that treatment and prognosis significantly differ. However, the distinction between the two forms is somewhat arbitrary in that a significant number of juveniles exhibit adult response patterns and a significant number of adult, "maturity-onset", diabetics exhibit juvenile response patterns (Danowski, 1971).

II. Societal Characteristics of Diabetics

The Literature provides information about prevalence, incidence, and mortality associated with diabetes.

Prevalence-Incidence

Information from which estimates of diabetes have been derived are based upon:

1. household interviews, usually covering a sample of the noninstitutionalized population.
2. examination involving routine urinalysis or blood sugar testing of samples of the noninstitutionalized population.
3. examination of special groups, on a sample or comprehensive basis, i.e., federal employee groups, community detection campaign groups.
4. hospital admission or discharge records, and special rosters.

The major source of current information on the prevalence of known diabetes in the United States is derived from the Health Interview Program of the National Health Survey conducted by the Public Health Service, a division of the United States Department of Health, Education, and Welfare. The survey is based upon a nationwide probability sample and involves a limited number of household units - approximately 42,000 households.

Prevalence rates for existing undiagnosed diabetes have been published by the Diabetes and Arthritis Program of the Division of Chronic Diseases of the United States Public Health Service. These estimates were based upon a composite derived from various types of diabetes detection activities--for example, the Oxford, Massachusetts Survey 1946-47 (Weherson, 1947), the Tecumseh Study 1959-60 (Mayner, 1965), and the Health Examination Study of the National Health Survey, 1959-62 (Table 6-2). According to Danowski (1971) there are presently 26 million diabetics in the world. One out of four or almost 50 million people are carriers (they transmit the tendency but are not afflicted themselves.

There is some disagreement as to the number of new cases reported yearly. According to a national health survey conducted by Health, Education, and Welfare, about 325,000 persons per year learn they have diabetes. (*Diabetes Source Book*, 1968; U. S. Division of Chronic Disease Programs, 1968). According to Schmitt (1956) the incidence rate is 72,000 yearly, a much lower figure.

Mortality. Diabetes continues to rank as the eighth leading cause of death in the United States. Diabetes accounts directly for 35,000 deaths annually as certified by attending physicians and is listed as a contributory cause on an equal number of death certificates. It is further estimated that another 37,000 diabetics died during 1966, but that their diabetes was not mentioned on the death certificate. However, on death certificates where diabetes was mentioned, less than one half (40.8%) designated diabetes as the underlying cause; 45% of the diabetics died of cardiovascular-renal disease (Vital Statistics of the United States, 1966).

According to the Bureau of Vital Statistics, in 1966, the mortality rate for diabetes mellitus was 17.7/100,000 populates. If this mortality rate is categorized according to sex and ethnicity it becomes evident that non-white females have the highest mortality rate (26.8/100,000 populates) and white males the lowest mortality rate (14.7/100,000 populates).

TABLE 6-2
MORTALITY RATE FOR DIABETES MELLITUS

Ethnic Group	Sex Females	- Male	Source
White	19.6	14.7	Vital Statistics of the United States, Division of Vital Statistics, National Center for Health Center for Health Statistics, Public Health Series, 1966.
Non-white	26.8	15.1	

Source: National Health Survey, 1959-1962

According to Marks (1961), the non-white male age-adjusted rates are 15% higher, and female age-adjusted rates are 66% higher, than the corresponding rates for white males and females.

Longevity. Treatment with insulin and antibiotics has resulted in a dramatic increase in the life expectancy of diabetics, particularly the young. See Table 6-3. According to Cull and Hardy (1974), the juvenile diabetic had diabetes for 21.8 years before death; and the average adult patients had diabetes for 18.1 years at the time of his death. Even so, their life expectancy regardless of attained age is still only about two-thirds that of the general population, according to the Joslin Clinic, Boston, Massachusetts. This clinic has kept detailed medical records of diabetes patients who were treated over a period of nearly three-fourths of a century (Marks, 1961).

In the days before insulin, 50 years ago, 40 to 60% of all diabetic patients who died did so in coma with or without accompanying infection (Cull and Hardy, 1974). It was the unusual diabetic child who lived longer than 2 years (Cull and Hardy, 1974). However, the utilization of insulin and various antibiotics has resulted in a dramatic increase in the life expectancy of diabetics, particularly the young. Even so their life expectancy regardless of attained age is still only about two-thirds that of the general population. See Table 6-4.

These figures were gathered from the medical records of diabetic patients at the Joslin Clinic, Massachusetts.

It should also be noted that drugs alone do not increase the diabetic's life expectancy. As is true of most diseases, both chronic and acute, early diagnosis and treatment of diabetes results in increased longevity as well. See Table 6-5.

TABLE 6-3
JOSLIN CLINIC, BOSTON, MASSACHUSETTS, PATIENTS WITH DIABETES: REMAINING YEARS OF LIFE AT SELECTED AGES

Attained age (years)	Remaining Life Years (Expected)	
	Patients with diabetes[1]	U.S. White population 1949-1951
10	44.3	61.5
15	40.0	56.7
20	36.1	51.9
25	32.8	47.2
30	30.1	42.5
35	27.2	37.9
40	23.7	33.3
45	20.2	28.9
50	16.9	24.7
55	13.8	20.8
60	11.3	17.8
65	9.2	13.9
70	7.2	10.9

[1] Experience 1947 to 1951 for diabetic patients first observed 1930 to 1951. (Analysis by Metropolitan Life Insurance Company.) Excludes deaths within one week of first observation or hospital discharge.

Source: Marks, H.H. Current concepts in diabetes mellitus: Vital statistics. New York State Journal of Medicine 61:602-616, February 15, 1961.

TABLE 6-4
JOSLIN CLINIC, BOSTON, MASSACHUSETTS, PATIENTS WITH DIABETES: DURATION OF LIFE AFTER ONSET OF DIABETES, BY AGE AT ONSET AND ERA OF TREATMENT[1]

Age at onset[2]	Eras of Treatment				
	1897-1914	1922-1929	1937-1943	1956-1959	[3]1960-1966
	Number Years Onset[2] Diabetes to Death				
All ages	4.9	8.0	12.1	16.7	16.7
0-09	1.3	2.8	10.3	24.2	26.0
10-19	2.7	3.4	11.4	21.8	23.6
20-39	4.3	8.9	16.9	23.8	24.2
40-59	7.0	9.5	13.4	17.5	17.3
60+	4.4	5.5	8.6	10.4	10.2

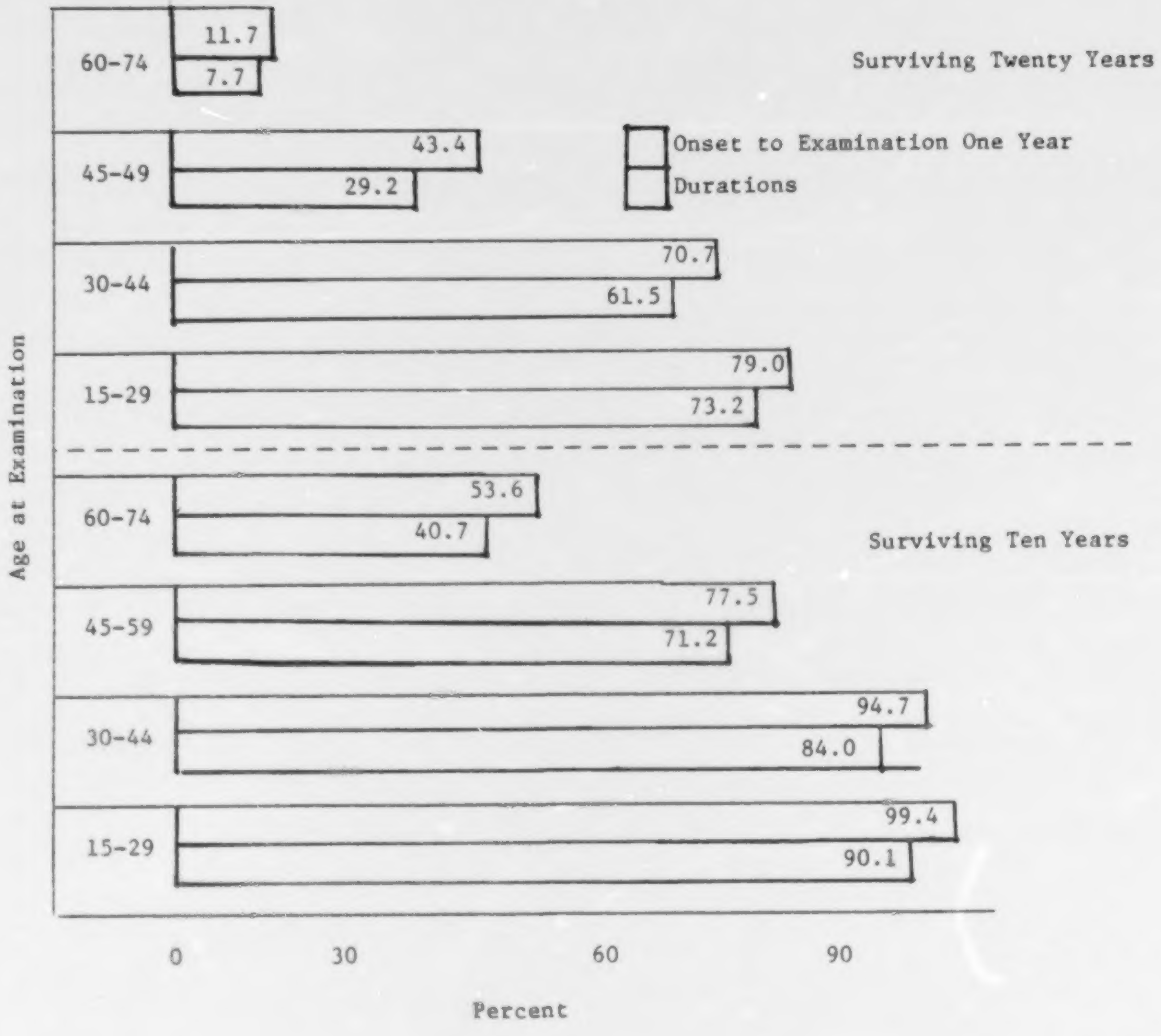
[1] Based on cases with known duration.

[2] Onset as judged by the Joslin Clinic.

[3] Deaths reported to March 31, 1966.

Sources: Joslin, E. P., Root, H. F., White, P., and Marble, A. The treatment of diabetes mellitus, Philadelphia: Lea and Febiger, 1959, p.225.

TABLE 6-5
SURVIVORSHIP OF JOSLIN CLINIC PATIENTS, BY AGE AT EXAMINATION AND BY DURATION FRON ONSET TO EXAMINATION



Source: Joslin, et al., 1959

Costs. The annual cost of diabetes to the United States is estimated to be at least $2 billion. The costs are broken down into three major areas:

1. Potential Earnings Loss. This includes persons unable to carry on usual activities: unable to work, and value of services of homemakers unable to keep house; sickness absenteeism; persons in institutions; life-time earnings lost due to diabetes - caused deaths. The cost in this area amounts to $1,334,000,000.
2. Estimated Costs of Medical Services and Supplies for Diabetes. This includes: hospitalization; surgical fees; diagnostic tests; lab tests; drugs; equipment; physician fees and nurses fees; nursing home care; nursing home medical care. The cost in this area amounts to $523,000,000.
3. Estimated Other Costs Because of Diabetes. This includes: research; vocational rehabilitation; screening; training; construction; insurance. This cost in this area amounts to $19,000,000.

See Table 6-6. Costs which are not present in the table include the loss of 11,000 productive man years annually due to sickness absenteeism; and 500,000 lifetime man years of production due to premature death from diabetes (Diabetes Sourcebook, 1968).

III. Demographics

Age. Diabetes mellitus affects men and women of all ages. However, in the United States, it is ten times more prevalent after age 45 than before age 45, with 80% of diabetics being past 40 years of age and approximately 40% being over 65 years of age (Diabetes Source Book, 1968). Only 5% of the total diabetic population are affected with juvenile diabetes, the chance of

TABLE 6-6
ESTIMATED EARNINGS LOSSES DUE TO DIABETES

	(In millions)
Total (annual)	$1,344.0
Persons unable to carry on usual activities (civilian noninstitutional population), total	$ 570.0
Unable to work	442.0
Value of services of homemakers unable to keep house	128.0
Sickness absenteeism among currently working persons	74.0
Persons in institutions (diabetes primary cause)	?
Value lifetime earnings lost due to diabetes-caused deaths, 1966 (discounted 6 percent)	700.0

Estimated Costs of Medical Services and Supplies for Diabetes

	(In millions)
Total (annual)	$ 523.0
Hospitalization (room fees)	170.0
Surgical fees and incidentals during hospitalization for surgery	11.0
Other hospital service fees	?
Blood sugar tests diagnosed diabetics seeing doctor	42.0
Urine tests, diabetics who test urine	9.0
Drugs: insulin and oral drugs only	148.0
Other drugs	?
Equipment: needles, syringes, etc.	8.0
Physician visits	90.0
Nursing home care (resident fees)	45.0
Nursing home medical care fees	?
Nursing care (visiting, practical, private duty)	?

Estimated Other Costs Because of Diabetes

	(In millions)
Total (annual)	$ 19.1
Research:	
National Institutes of Health	17.0
Diabetes and Arthritis Control Program	0.3
Vocational rehabilitation of persons with diabetes as primary cause of disabling condition:	
Civilian program	1.0
Veterans Administration	?
Case finding (blood testing reported to PHS)	0.8
Training	?
Construction	?
Net cost of insurance	?

Source: Diabetes Sourcebook, 1968

diabetes mellitus occurring among children under 15 years old being only one in 2,500 (Joslin, 1972, p. 656).

Percent of all cases diagnosed at various ages:

Age Group	Percent of total
0-20	5
20-40	10
40-60	40
60+	45
	100

Source: Oakley, 1973, p. 26.

The Diabetes Source Book further documents that the prevalence of diabetes mellitus rises rapidly with age:

Age	Number per 1000 population
Under 25	1.6/1000
25-44	8.0/1000
45-54	20.0/1000
55-64	43.7/1000
65-74	64.4/1000
75+	57.9/1000

Essentially, then diabetes is a chronic disease of the middle aged and elderly.

Sex. In juvenile diabetes, the incidence in males and females is approximately equal. However, in most countries adult diabetes is more common in women than men. This is because of the greater ratio of women to men in middle age. Under age 40, the condition is actually slightly more common in males. In the 50 and 60 age category, diabetes is nearly twice as common in women as in men (Oakley, 1973).

In 1966 in the United States, the overall prevalence rate of diagnosed diabetes for males was 12.9 per 1,000 population, and 16.1 per 1,000 population for females (Diabetes Source Book, 1968).

Ethnicity. Data collected by the United States Public Health Department indicates that non-white females over 45 have the highest prevalence of diabetes--68.6/1000 population. This figure compares with 35.5/1000 population for white females. Males have approximately the same incidence regardless of ethnic origin--29.7/1000 population for white males and 29.6/1000 population for non-white males. See Table

Socio-economic. There is a higher prevalence of diabetes in lower income families. According to a National Health Survey, families with annual incomes of less than $3000 reported a 33% incidence of diabetes, while families with annual incomes of $10,000 and over had a 12.5% incidence of diabetes. (See Table

Looking at the table, the rate of diabetes mellitus for incomes under $4,000 is more than double that where incomes are $4,000 or higher. About 45% of the diagnosed diabetics come from families with an annual income below $4,000. The table also indicates that 50% of the diabetics have less than a ninth grade education. Diabetics therefore appears to be most prevalent among the poor.

Urban-rural. Diabetes is seen more frequently in urban than rural areas (Marble, White, Bradley, Krall, 1971, p. 14).

Geographic region. The frequency of diabetes varies by region in the United States. The pattern is similar for both mortality and morbidity frequency rates. The highest prevalence rates occur in the New England, Middle Atlantic and West North Central states. The rate for the highest region (middle Atlantic States) was 1.9 times that of the lowest [West South Central States (*Diabetes Fact Book*, 1961)].

TABLE 6-7
DEMOGRAPHY. DIAGNOSED DIABETES RATES BY AGE, SEX AND COLOR, UNITED STATES, JULY 1964-JUNE 1965

Age	Total	Male	Female
	(Rate/1,000 population)		
		White	
All ages	12.1	10.8	13.2
Under 45 (rates not sex or race relative)	3.0	3.0	3.0
45+	32.8	29.7	35.5
		Non-white	
All ages	13.3	8.4	17.8
Under 45 (rates not sex or race relative)	2.8	2.4	3.1
45+	50.2	29.6	68.6

Souce: Diabetes reported in interviews, July 1964-June 1965. Division of Health Interview Statistics, National Center for Health Statistics, Public Health Service (civilian noninstitutional population).

TABLE 6-8
NATIONAL HEALTH SURVEY, FAMILY INCOME AND EDUCATION OF INDIVIDUAL

Family income and education of individual	Rate per 1,000 population[1]	Percent distribution
All		100.0
Family Income		
Under $4,000	20.8	45.2
$4,000+	8.6	48.1
$4,000-6,999	8.2	20.1
$7,000-9.999	8.9	15.0
$10,000+	10.1	13.0
Not Reported	* * *	6.7
Years of Education		
Under 5	* * *	14.5
5-8	* * *	35.4
9-12	* * *	35.7
13+	* * *	9.3
Not Reported	* * *	5.0

[1] Not previously published.

Source: Characteristics of persons with diabetes, United States, July 1964-June 1965. Unites States Department of Health, Education, and Welfare, Public Health Service Publication No. 1000-Series 10-No. 40, October 1967. Washington: United States Government Printing Office.

IV. Etiology

The etiology of diabetes is complicated. In the great majority of cases there seems to be no single cause of the condition. However, researchers point to a number of factors which increase the chances of an individual acquiring diabetes mellitus. These factors include:

Age,
Sex,
Body weight,
Inheritance,
Virus infection,
Trauma - physical and emotional,
Growth hormone.

Age. Diabetes is more common in the second half of life than the first. After age 45 the incidence rises sharply and in old age diabetes is common. This increasing incidence of diabetes with age reflects a general change in glucose colerana, with blood glucose levels rising with age. For example, over the age of 70 about 15% of the population show mildly "abnormal" glucose tolerance, although they are not necessarily diabetic. Thus the distinction between diabetes and normality may not always have much meaning.

Sex. In most countries diabetes is more common in women than men. This is due to a greater proportion of women in middle age. Under 40 the condition is actually more common in males, while in the fifties and sixties, diabetes is nearly twice as common in women as in men. Recently, the differentiation by sex due to age, appears to be changing with women between the ages of 40 through 60 ceasing to outnumber men although they still do so in old age (Oakley, 1973). The reasons for differences in sex incidence are not known. However, researchers offer three possible explanations: parity, effects of menopause and obesity.

Parity. Women developing diabetes in middle and late life have borne a larger number of children (higher parity) than have non-diabetic women. Interestingly, the effect of parity is delayed, not appearing until after the age of about 45-50. That is, women of high parity do not develop diabetes earlier than those of low parity (Oakley, 1973).

The prevalence of diabetes is also greater among mothers who have given birth to a baby that weighed 9 pounds or more. It has further been fairly well established that gestational diabetes (abnormal carbohydrate tolerance during pregnancy only, returning to normal after delivery) is related to future development of the disease. O'Sullivan (1961) found that 67% of women who were classified as gestational diabetics developed overt diabetes within six years.

In studying the relationship of pregnancy to diabetes it is important to take into account the effect of the mother's age and weight status. However, the exact relationship between factors that are associated with pregnancy and diabetes is not known.

Menopause. Menopause may result in increasing blood glucose levels although there is no conclusive evidence at this time.

Obesity. Obesity is an important causative factor in diabetes. Diabetics are, on the average, overweight, and obesity is associated with insulin insensitivity. According to Joslin (1959), obesity precedes diabetes in 85% of the cases.

A screening of federal employee diabetics from July 1963-June 1964 indicated many were overweight.

Number per 1000	Weight
7.8	Normal weight
16.4	10-19% overweight
25.6	20-29% overweight
52.4	30-39% overweight
58.0	40-49% overweight
96.8	50%+ overweight

The researchers also found that rate of diabetes was 1.5 to 4 times higher among overweight than normal weight persons of the same age.

	Rate of Diabetes/1000	
Age	Normal Weight	10% Overweight
20-29	3.3	4.9
30-39	3.1	11.1
40-49	6.1	21.8
50-59	18.4	56.4
60+	20.1	74.1

Young diabetics are not, as a rule, overweight, but about 50% of diabetics diagnosed over the age of 45 exceed their expected weight by 10%, compared with only 25% of non-diabetics.

The Society of Actuaries (1959), who conducted a survey on the relationshop of obesity to diabetes found: among men 20% or more overweight, the mortality from diabetes was 133% greater than that among all persons insured as standard risks. Among women 15% or more overweight, the mortality from diabetes was 83% over that among women in the non-diabetic population. The degree of excess mortality from diabetes increased with the degree of "overweightness." Among males it was more than 300% for those about 35% overweight and even greater for those more obese.

Inheritance. Inherited factors have some importance in causing diabetes but researchers do not fully understand how they work (Oakley, 1973; Danowski, 1967; Marble, et. al., 1971). About 40% of all diabetics know of an affected relative. It has been found that blood relatives of diabetics have a high risk of developing the disease, and that the risk increases if the disease is present on both sides of the family.

In a Florida study, prevalence rates for new diabetes with diabetic relatives were compared with estimated undiagnosed diabetes prevalence rates in the general United States population. It was found that the prevalence rate for 1958-1959 was 41.0/1000 population among diabetics with diabetic relatives as compared with 17.1/1000 (1957-1959) for the general United States population. Diabetes rates were found to be higher at every age (Diabetes Source Book, 1968).

Age	New Diabetes Among Relatives of Diabetics (Florida)	Estimated Undiagnosed Diabetes Prevalence (United States)
0-24	3.1	0.7
25-44	17.2	5.2
45-54	39.0	17.9
55-64	39.5	24.2
65-74	45.5	26.2

Virus Infections. "Acute, juvenile-onset diabetes, but not the maturity-onset type, has a seasonal incidence, new cases being more common in winter than in summer, and there are occasional small 'outbreaks' of diabetes. The observations raise the possibility of an infective cause for some cases. It is known that viruses can cause diabetes in animals and the possibility of a similar cause in humans therefore seems reasonable. Suspicion has settled on the Coxackie B_4 and mumps strains of viruses" (Oakely, 1973). Steinke and Taylor also cite evidence which points to a relationship between certain viruses and diabetes mellitus.

Trauma. Bodily injury is seldom, if ever, important in the etiology of diabetes. Although the pancreas might be injured, the damage would have to be so severe as to hardly be compatible with life. There is no evidence that brain injury alone leads to diabetes, nor that psychological stress causes diabetes, although it can aggravate an already established case of diabetes (Koch and Molnar, 1974, Treuting, 1962; Hinkle and Wolf, 1952).

Growth Hormone. Luft ([illegible]) notes that the growth hormone levels in blood seem to be raised in diabetics. Therefore, he suggests that the growth hormone should be regarded as a factor being able to precipitate diabetes in prediabetic individuals. He further states that the growth hormone, provided diabetes is present, may play a role in the development of vascular complications in diabetics.

V. Life Functions

In applying the five categories of life functions to the disability, diabetes, it becomes quite evident that health is the major life function affected. Specific diseases due to diabetes debilitate individuals to a significant degree, especially those with diabetes for an extended period (10 years or more). These health diabilities also affect other life functions and cause less than normal functioning in the areas of social-attitudinal and mobility functioning and to a lesser extent cognitive-intellectual. The life function of communication is not significantly affected by the disease of diabetes.

Health. Most diabetics suffer from other chronic conditions besides diabetes mellitus. According to the National Health Interview Survey (conducted July 1964-June 1965), 80% of the respondents to a supplemental diabetes interview reported one or more conditions in addition to diabetes. Twenty-one percent indicated they suffered from heart disease, and 17% had high blood pressure. Other conditions with a comparatively high prevalence among diabetics were visual impairment (16.9%) and genitourinary conditions (8.3%). See Table 6-9 and 6-10.

According to Holt (1962), diabetic morbidity and mortality result from coronary sclerosis, arteriosclerosis, gangrene, infection, mephropathy, hypertension, retinopathy and polyneuropathy.

TABLE 6-9
DIAGNOSED DIABETES, BY NUMBER OF OTHER CHRONIC CONDITIONS AND ACTIVITY LIMITATION, UNITES STATES, JULY 1964-JUNE 1965

Number of other chronic conditions	Persons with Diabetes		
	Both sexes	Male	Female
	Percent Distribution		
Total	100.0	100.0	100.0
None	19.9	25.1	16.2
One	22.2	23.0	21.5
Two or more	57.9	51.9	62.3

Source: Characteristics of Persons with Diabetes, United States, July 1964-June 1965. United States Department of Health, Education, and Welfare, Public Health Service Publication No. 1000-Series 10-No. 40, October 1967. Washington, United States Government Printing Office.

TABLE 6-10
OTHER CONDITIONS AMONG PERSONS WITH DIABETES, UNITED STATES, JULY 1964-JUNE 1965

Selected conditions in addition to diabetes	Persons with Diabetes	
	Number[1] (in thousands)	Percent of total
Heart condition	485	21.1
Hypertension without heart involvement	387	16.8
Vascular lesions, CNS	76	3.3
Imparied vision, total	389	16.9
Impaired vision	238	10.3
Blind, both eyes[2]	151	6.6
Cataracts	93	4.0
Glaucoma	36	1.6
Genitourinary disorder	190	8.3
Gallbladder	84	3.7
Skin disorder	75	3.3
Goiter and thyroid conditions	71	3.1
Paralysis, complete or partial	50	2.2
Gout, tuberculosis, or senility	35	1.5
Absence of:		
Fingers, toes	51	2.2
Major extremities	33	1.4

[1] Many persons have more than one condition.

[2] "Inability to read ordinary newspaper print with glasses and impairment indicating no useful vision in either eye." Not to be equated with legal blindness.

NOTE: Neither visual impairment nor any other condition in this table is to be interpreted as caused by diabetes.

Source: Characteristics of persons with diabetes, United States, July 1964-June 1965. United Stated Department of Health, Education, and Welfare, Public Health Service Publication No. 1000-Series 10-No. 40, October 1967. Washington: United States Government Printing Office.

TABLE 6-11
LIFE FUNCTION: HEALTH

State of Problem	Dynamic	Source
Cerebral Aterosclerosis	Occurs more frequently among diabetics, in all age groups, than in normal population.	Grunnett, 19 ; Holt, 1962.
Infections	Wounds take longer to heal among all diabetic groups.	Holt, 1962.
Gangrene	Occurs in patients with long-term diabetes.	Oakley, 1973
Retinopathy	The most common complication of long-term diabetes.	Oakley, 1973
Neuropathy	Occurs most frequently in older diabetics.	Holt, 1962
Kidneys (Nephropathy)	The longer one has diabetes the greater the chance of nephropathy.	
Impotence - due to physiological factors	Male diabetes.	Kolodny, 1962

Eyes. The most common long-term complication of diabetes is retinopathy. In most cases retinopathy produces no symptoms, but in a few it leads to blindness. Diabetes can produce changes in various parts of the eye in the conjunctiva, lens iris as well as the vitreous and retina. Blindess is nearly always due to lesions of the lens vitreous or retina, along or combined (Oakley, 1973). The term diabetic retinopathy is generally used to describe abnormalities in the vitreous as well as the retina, and thus it is diabetic retinopathy that leads to blindness.

Retinal lesions are common in diabetics. The longer the duration of the diabetes the more common they are.

Prevalence of clinically detectable retinopathy in relation to known duration of diabetes among 3,438 patients attending King's College Hospital (Oakley, 1973).

	DURATION OF DIABETES (YEARS)							
	0	1-5	6-10	11-15	16-20	21-25	26-30	31+
Prevalence of Retinopathy (percent)	6.4	12.9	24.3	38.6	57.9	65	63	56

It is rare to find any retinal abnormality in children but among those diagnosed over the age of 60, retinopathy is already present in over 1/10 at the time of diagnosis.

Prevalence of retinopathy (percent) in relation to age at diagnosis and known duration of diabetes [(3,438 cases) Oakley, 1973].

	DURATION OF DIABETES (YEARS)			
Age of Diagnosis	0	1-10	11-20	21+
0-19	0	7	38	67
20-39	3	10	55	58
40-59	4	25	50	62
60+	11	24	33	-

Although retinopathy is common, in the great majority of cases it produces no symptoms and in most never will, with one-third of patients who have had diabetes for 30 years still having normal fundi (the base of the eye).

Diabetics have a much greater chance of blindness than the population at large. A diabetics' risk of going blind is about 10 times that of a non-diabetic, with approximately 7% of all diabetics being totally blind. Presently, diabetes is the third leading cause of blindness in this country. According to the National Society for the Prevention of Blindness, for 11.2% of those totally blind or 44,660 persons, causation was diabetes. See Table 6-12.

Neuropathy. Stewart (1925) reports that neuropathy was found in 50% of the cases of diabetes mellitus. Neuropathy is chronic and progressive and can begin early in the diabetic. Remission is partial but complete resolution is unusual (Holt, 1962). Neuropathy is a complication of diabetes due to the involvement of the peripheral nerves, especially the sensory nerves, and usually affects the legs. The condition occurs more frequently with increasing age, being rare in children and adolescents. Neuropathy takes various forms and various degrees of severity ranging from pain, paresthesia (numbness, tingling, pins-needles, and coldness in the extremities), ataxia, achilles areflexia, and patellar areflexia, muscle weakness and wasting to impotence, diarrhea, and retention of urine in the bladder (Holt, 1962).

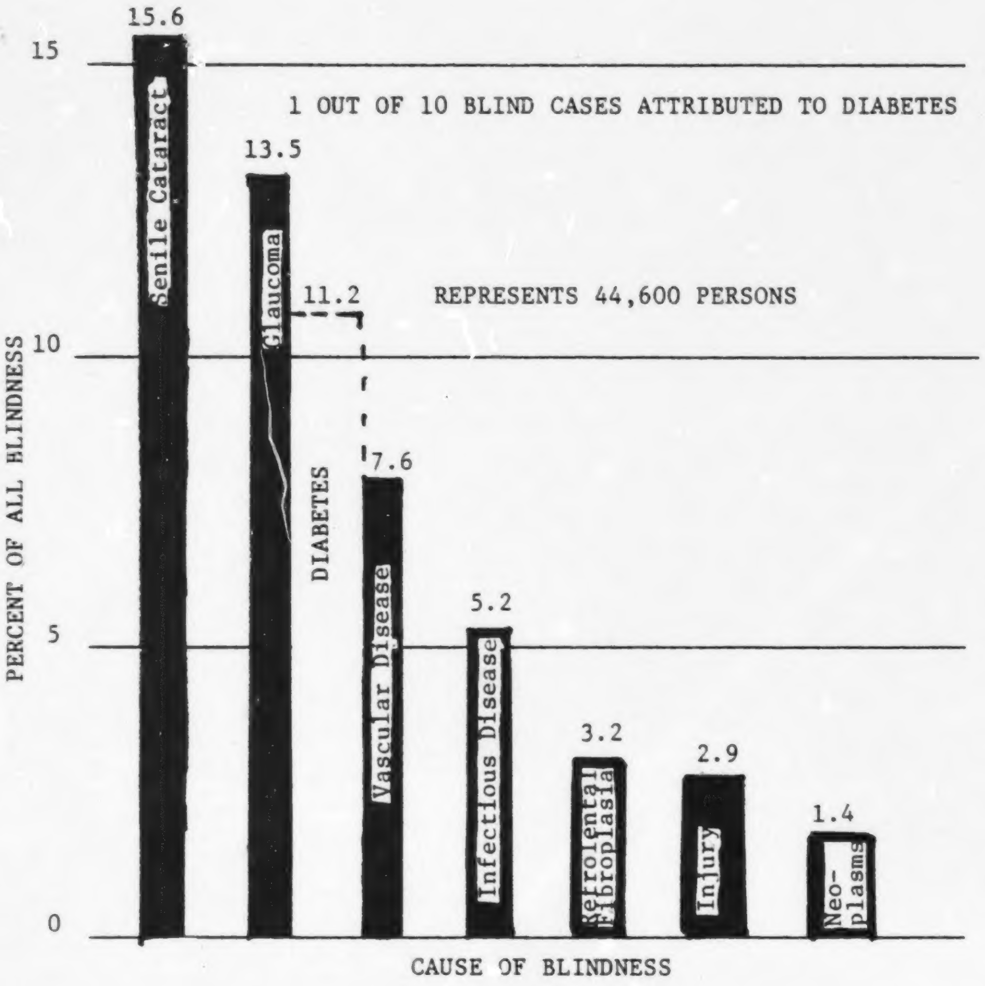
Kidneys. Diabetic nephropathy is a term applied to the condition produced by diabetic glomerulosclerosis (hardening of the arteries in the kidneys). The prevalence of nephropathy is related to the duration of the diabetes, and the condition is seldom recognizable clinically in the first 10 years.

TABLE 6-12
ESTIMATED NUMBER OF LEGALLY BLIND PERSONS,[1] BY CAUSE, UNITED STATES, 1962

Cause	Legally Blind Persons	
	Number	Percent
All causes	399,300	100.0
Infectious diseases	20,950	5.2
Ophthalmia neonatorum	1,200	0.3
Syphilis	8,400	2.1
Other	11,350	2.8
Injuries	11,700	2.9
Poisonings	13,800	3.5
Retrolental fibroplasia	12,710	3.2
Other	1,090	0.3
Neoplasms	5,730	1.4
General diseases	81,300	20.4
DIABETES	44,660	11.2
Vascular	30,250	7.6
Other	6,390	1.6
Prenatal influence	66,510	16.7
Unknown to sicence	151,850	38.0
Glaucoma	54,020	13.5
Senile cataract	62,310	15.6
Myopia	17,290	4.3
Other	18,230	4.6
Undetermined and not specified	47,460	11.9

[1] "Visual acuity for distant vision of 20/200 or less in the better eye, with best correction; or visual acuity of more than 20/200 if the widest diameter of field of vision subtends an angle no greater than 20 degrees."

Source: Estimated statistics on blindness and vision problems. NSPB Fact Book, 1966. The National Society for the Prevention of Blindness, Inc., New York.



Source: Adapted from Characteristics of persons with diabetes, United States, July 1964-June, 1965. U. S. Department of HEW, (Public Health Service Publication No. 1000 - Series 10-no. 40). Washington, D.C. U.S. Government Printing Office, October, 1967.

Selected causes of blindness, United States, 1962

Figure 6-1. Selected causes of blindness, United States, 1962

In the great majority of cases of diabetic nephropathy, there is also retinopathy. Proteinuria (the presence of protein in the urine) is present in about 15% of patients who have been diabetic for 20 years, but rarely develops in less than 10 years. Glomerulosclerosis is the most common specifically diabetic cause of death and is responsible for about 10% of deaths of diabetics. Many patients with proteinuria never develop clinical evidence of nephropathy, and the presence of the renal lesions may be evident only at post-mortem (Baladimos, 1971).

There are a number of other health problems which face the diabetic:

1. When not under medical care and not practicing good personal care, the diabetic has lower resistance than the normal individual and is more susceptible to pulmonary tuberculosis, pneumonia, skin diseases and eye diseases such as cataracts, inflammation or hemorrhage of the retina, and at times total loss of vision (Meissner and Legg, 1971).
2. There is also danger of slow or defective healing of wounds, cuts and breaks in the skin and nonunion of bone facilities (Oakley, 1973).
3. Gangrene is a prominent hazard in injuries to the legs and feet, especially with older diabetics, where there is a tendency toward arteriosclerosis which causes poor circulation in the legs, feet and toes (Meissner and Legg, 1971).

Social-Attitudinal. There is considerable agreement that psychological and environmental experiences are associated with fluctuations in the course of the illness of at least some diabetics (Treuting, 1962; Kimball, 1971; Slawson, et. al., 1963; Danowski, 1963; Baker, 1970). The mechanism by which the emotional triggers the physical reaction is poorly understood.

Studies have suggestes that events generating anxiety (Mersky, 1948), specific intrapsychic conflicts (Meyer, et. al., 1945), "emotional starvation" (Hinkle, 1951), conscious or unconscious threats to security (Hinkle, 1952), and acutely unpleasant psychologic experience (Vandenbergh, 1966) and undesirable life events (Grant, 1974) may affect diabetic control. The physiological changes include: increased excretion of glucose, water and chlorides, ketonemia and alterations (increases of decreases) of the blood glucose level. It is also more likely that diabetes mellitus will appear in a setting of sustained and chronic emtional conflict than that it will be precipitated by an exceptional emotional trauma.

A diagnosis of diabetes is believed to induce deeper, more stirring anxiety than a diagnosis of other chronic disease (Bruhn 1974). The diabetic faces dietary restriction that virtually eliminates many highly gratifying foods. The disease can require daily self-administration of medication hypodermically and carries some threat of disaster if this ritual is not observed (coma). Daily urine testing can intensify this treatment, giving evidence of any deviation from strict control. In addition to the patient's active participation in treatment, control depends in part on his judgment in unusual situations. Diabetes places on the patient far greater responsibility for maintenance of disease control than is true of most other diseases (Bruhn, 1974).

Diabetics often experience the following:

1. Some patients react as if they themselves caused the disease and become fearful that responsibility for its cause rests with them.
2. Adolescents often feel different and therefore set apart from the other members of the group.

3. Diabetics often try to hide the fact of their illness for fear that their job may be jeopardized or, in the case of young people, that they may be unable to attract a spouse.

There also appears to be a higher occurrence of psychiatric disturbances in diabetics than non-diabetics (Trueting, 1962). Hawkins suggested that these patients use their disease as a means of escape, either by entering the hospital or by attempting suicide. Some diabetics eat improperly rejecting their diet, go on food sprees, falsify urine tests, and neglect insulin requirements purposively. This self-destructive behavior is particularly apparent among younger diabetics. Adolecents must deal not only with their illness but with puberty, marriage and vocational problems. See Table 6-13.

Personality. Researchers have tried to postulate a diabetic personality (Ludz, 1954; Palmer, 1958; Crowell, 1953; Bruch, 1949; Daniels, 1936, 1939; Mershy, 1938, 1952). However, as a group diabetics are in the normal range of personality (Murawski, et. al., 1970). It becomes evident that there is no general personality type. It should also be noted that one finds abnormal as well as normal personality types among diabetics. The great varieties in personalities as a result of differences in severity of the disease, differences in cultural backgrounds and differences in environmental factors among diabetics. Some diabetics are able to cope with their disease and maintain a "normal" personality, while others will have feelings of pessimism, hopelessness and long periods of depression. Others may become suicidal, especially those with uncontrolled (juvenile) diabetes (Ludz, 1954; Palmer, 1958, Crowell, 1953; Bruch, 1959; Daniels, 1936, 1939; Mershy, 1938, 1952). Murawski (1970) also found that men appear to have more personality problems. He postulates that this may be due to the role definitions in contemporary American society - men having a greater need

TABLE 6-13

LIFE FUNCTION: SOCIAL ATTITUDINAL

State of Problem	Dynamics	Source
Anxiety - due to self-regulation of drugs and diet.	Juvenile and mature	Bruhn,
Isolation-feelings of abnormality.	Predominantly among juvenile diabetics.	Hawkins,
Self-destructiveness	Juvenile diabetics.	Hawkins,
Depression, hopelessness	Juvenile, uncontrolled diabetes.	Andy, 1954, Palmer, 1958, Crowd, 1953, Brunch, 1959

to deny their illness or to present themselves as defective or "sick." Swift, Leedman, and Stem (1967) reported that diabetic children were more emotionally disturbed than non-diabetic controls. However, Collier (1969) found no differences in the interpersonal traits of secondary school adolescents with and without diabetes.

One would have to conclude that while diabetes is associated with personality disorders in some cases, the effects are not universal nor uniform.

Sexual Dysfunction. Sexual dysfunction is a common complication of diabetes mellitus in both men and women (Rundles, 1945; Rubin, 1958, Schoffling, 1963; Ellenberg, 1966; Ellenberg, 1971; Kolodny, 1971). According to Rubin (1958) male diabetic patients have sexual disturbances not only at an earlier age, but two to five times more often than other healthy men. Researchers have found impotence in males is due to either neurogenic factors and/or hormonal factors. Impotence therefore is due to organic rather than psychological causes. According to a study conducted by Kolodny, et. al. (1974) diabetic men with organic impotence have continued sexual interest despite the slow onset of erectile dysfunction, often described at "50% firm." They generally have an inability to masturbate or stimulate erection in any way.

Studies have undercovered two possible physiological causes. Faerman (1974) and Ellenberg (1971) concluded that male sexual impotence was due to a neurological lesion of the nerve fibers that control erection (a form of neuropathy). Schoffling, et. al. (1963) on the other hand, concluded that the cause of impotency and infertility was due to hypogonadoltopic hypogonadism. Thus they suggest an endocrine basis for sexual dysfunction.

Childbearing. Female diabetics who suffer few complications are not advised against having children, although most physicians appear to agree that diabetic women should not have more than two to three children (Wiese, 1974). However, if a female diabetic has major complications the situation is different, particularly if there is evidence of renal damage. Oakley (1973) believes it is not fair to the woman or child, if she is not likely to live for more than a few years or has serious eye complications and may go blind within a short time.

Mobility. The National Health Interview Survey (July 1965-June 1966) reported that 562,000 diabetics are limited in their ability to work, keep house, or engage in scholastic activity, and 168,000 of these are entirely unable to perform their major activity. Six percent of all diabetics are confined to their homes or unable to move about without difficulty. Annual statistics from the survey offer some indication of the problem: (See Table 6-14).

38,800,000 days of restircted activity - person has to cut down on his usual activities for a whole day.

19,900,000 days of bed disability - spent more than ½ daylight hours in bed.

2,900,000 days lost from work.

Mobility limitations are due not only to diabetes, but to the other debilitating conditions which accompany diabetes. See Table 6-15.

Recreation and games need not be off limits to diabetics. The diabetic on tablets or diet usually needs to take no special precautions but the diabetic on insulin may need to take extra carbohydrate before or during exercise. The amount varies greatly and each diabetic should learn for himself what effect, if any, extra exertion has or his carbohydrate needs (Oakley, 1973). See Table 6-17.

Cognitive-Intellectual. Bale's study investigated the incidence of brain damage (as judged by psychological testing) in a group of patients with long-term

TABLE 6-14
DIAGNOSED DIABETES, BY TYPE OF LIMITATION ASSOCIATED WITH DIABETES, UNITES STATES, JULY 1965-JUNE 1966

Limitation	Number (in thousands)	Percent
Total	2,772	100.0
Chronic activity limitation		
Limited	562	20.3
Unable to carry on major activity[1]	168	6.1
Limited in major activity	312	11.2
Not limited in major activity, but otherwise limited	82	3.0
Not limited	2,210	79.7
Chronic mobility limitation		
Limited	157	5.7
Confined to house	75	2.7
Cannot get around along	25	0.9
Has trouble getting around along	58	2.1
Not Limited	2,615	94.3

[1] Ability to carry on the usual activity of the group of which he is a member (worker, housewife, school-age or preschool child).

NOTE: Does not include persons in nursing homes.

Source: Diabetes reported in interviews, July 1965-June 1966. Unpublished data. Division of Health Interview Statistics, National Center for Health Statistics, Public Health Service. (Civilian noninstitutional population.)

TABLE 6-15
DIAGNOSED DIABETES, BY TYPE OF LIMITATION ASSOCIATED WITH DIABETES, UNITES STATES, JULY 1964-JUNE 1966

Type of Limitation	Limitation due to		
	All conditions	Diabetes	Other conditions
	Days per diabetic per year		
Restricted activity	54.0	17.3	36.7
Bed disability	23.3	8.2	15.1

Source: Characteristics of persons with diabetes, United States, July 1964-June 1965. United States Department of Health, Education, and Welfare, Public Health Service Publication No. 1000-Series 10-No. 40, October 1967. Washington: United States Government Printing Office.

TABLE 6-16

LIFE FUNCTION: MOBILITY

Statement of Problem	Dynamics	Source
Recreation and Games	Special precautions need to be taken by diabetics using insulin.	Oakley, 1973
Confined to home	Six percent of all diabetics.	National Health Interview Survey, 1965-1971

insulin dependent diabetes mellitus. The results suggested a positive relationship between severe hypoglycemia episodes and brain damage as measured by learning tests. Treuting (1963) also cites the possibility that repeated episodes of hypoglycemia or coma, or both, produce brain damage, which in turn may be the bases for some of the disturbances of behavior and personality seen in patients with diabetes. Holt (1962) further notes that diabetic encephalopathy can cause inattention, unawareness, memory deficit and irritability.

Diabetics do not appear to suffer from any serious mental deficits because of their disease. Diabetic children usually manage well at ordinary schools and only occasionally does a diabetic child need to go to a special school.

VI. Functioning as a Member of Society

The literature provides information on a diabetic's functioning in the work force and the community.

Functioning as a Member of the Labor Force

The National Health Interview Survey (July 1963-June 1966) reported that 562,000 diabetics are limited in their ability to work, keep house, or engage in scholastic activity, and 168,000 of these are entirely unable to perform their major activity. Six percent of all diabetics are confined to their homes or unable to move about without difficulty. Annual statistics from the survey also note that 2,900,000 days are lost from work.

Difficulties arise in employment with diabetics on insulin. This is due to the special needs of these diabetics. They include regular meals; ensure physical exertion does not vary greatly from day to day; to see he does not work entirely along; does not include jobs where hypoglycemic attack would be disastrous - airline pilot, bus driver, window cleaner, operator of dangerous machinery. Jobs which involve changes of schedule - shift work or a great deal of travel and staying away from home, such as a salesman, present difficulties but they are seldom insurmountable. Diabetics on oral drugs and for diet rarely have special problems in the

TABLE 3-17

LIFE FUNCTION: COGNITIVE INTELLECTUAL

State of Problem	Dynamics	Source
Severe hypoglycemic episodes can cause brain damage.	Due to diabetic coma.	Treuting, 1963

area of employment apart from the need to keep to a diet (usually taken, packaged meals to work [Oakley, 1973]).

However, the majority of diabetics are employable and efforts are being made to include diabetics in the work force. Although it has been previously noted (see Mobility - Life Functions and Costs Sections) that diabetes results in job absenteeism, a study conducted by Moore and Ruschbom (1974) found that a diabetic group, age-matched to subjects in other studies of absenteeism in non-diabetics, compared favorably with the non-diabetic, statistics were collected on 108 employed diabetics over a four year period. The individuals in this group were absent an average of 6.3 days per work year.

The National Health Interview Survey found an even lower incidence of work absenteeism. Sickness absenteeism due to diabetes averaged 2.8 days per year among currently employed diabetes. Males average 3.2 days, females 2.1 after age 45, the average time lost by males was about twice that of females.

The United States Civil Service Commission has gone on record as believing persons with controlled diabetes are reliable employees and should be hired. A list of positions in the Federal Civil Service for which diabetics are eligible has been published (American Diabetes Association, 1952). According to Leibowitz (1965) there are good employment opportunities for diabetics in the New York City schools system.

The American Diabetes Association Committee on Employment has outlined job guidelines for people with diabetes and has also suggested standards for the employment of diabetics (Committee on Employment, American Diabetes Association, 1952, 1965). The local Chapters of the American Diabetes Association have also been active in this area through their committees. The

New York Diabetes Association Committee on Employment and Insurance has recommended standards for employment of diabetes (Friedman, 1966; Committee on Employment and Insurance, New York Diabetes Association, 1965). Forms were designed for use by the employer, the diabetic job applicant, and the diabetic's personal physician. The Committee defined criteria to guide the employer concerning the type of diabetics suitable for hazardous and non-hazardous jobs. The latter were subdivided into sedentary and manual. With this guidance, an employer can determine more accurately which diabetics he may employ and in what capacity.

Functioning as a Member of the Community

Diabetics can participate equally with other citizens in any communal activities, such as fund-raising campaigns, civic associations, religious activities, school board, and parent-teacher associations (Entmacher, et al., 1971). Diabetes does not impair a person intellectually, and the stable diabetic can indulge in vigorous exercise regularly--witness tennis player, Billy Talbert.

However, the diabetic still faces certain problems in the community. The major area of non-acceptance of diabetics being the labor force. A study done in 1957 by the American Diabetes Association indicates that, among the companies polled, only 67% of the small and 71% of the large ones employed known diabetics. Employers are often unsure of a diabetic's job performance and dependability (especially in the area of absenteeism). However, as previously noted in the life function section, absenteeism is equal to and in some cases less than that of non-diabetic workers. Diabetics are just as intelligent and often harder workers than non-diabetics. Efforts are being made through laws (i.e. Second Injury Laws - See Labor Force Section) and programs (especially those set up by the American Diabetes Association - see Work Section) to aid juvenile and mature diabetics in locating employment. There is still a need, however, to inform the public about the disease of diabetes especially in regard to its limitations.

The diabetic, in order to function as a full participant in society needs to learn to cope with his disease. If a diabetic is unable to adjust physchologically to the disease, or is not able to follow the prescribed treatment there is not possibility of adequate participation in the community. Therefore, there is a need for educational programs for the diabetic and his family. In the young patient, the disease lends itself very well to incorporation into disturbed parent-child/relationships.

In the case of young children, parental anxiety soon is transferred to them. Some mothers of diabetic children react defensively, becoming overzealous about diet to diminish their feelings of guilt. The children become aware that they can use food as a weapon in dealing with their environment and may overeat or refuse to eat out of spite, in provocation or revenge (Treuting, 1962).

Various segments of the population are attempting to meet these needs and have developed youth programs, summer camps, live-in training sessions, seminars and discussion groups (see Service Delivery Section). However this effort is only the beginning - a great deal of work still needs to be done in this area.

VII. Technologies

Diet is the fundamental element of therapy in most cases of maturity-onset diabetes. Unfortunately, understanding of, and especially adherence to, diet is poor. According to the National Health Survey (Holland, 1968) 22% of the diabetics interviewed "stated that they were never given a diet for their diabetes." Another 25% "had received a diet but said they didn't follow it." Only 53% of this respresentative sample of diabeties "indicated they they followed a prescribed diet." Even in the latter group, a substantial majority had a poor grasp of the fundamentals of the exchange method. Williams and Associates further confirmed the finding that only a minority followed their diet prescriptions.

Other difficulties in treatment result from the tendency for the disease to begin at emotionally cirtical periods in life, i.e., puberty, middle age. Also, diabetes is often accompanied by several incapacitating complications that are neither curable nor preventable by average care and treatment.

The emphasis on diabetes treatment is early diagnosis. It is hoped that massive screening will aid in the discovery of diabetes during the asymptomatic stage of the disease. It is believed that treatment soon after onset, along with good control of the condition, helps not only to prolong life but may prevent or delay the development of complications. Utilization of blood tests is the preferred method of diabetic screening due to the tests' easy reproducibility and high validity. Results of blood tests are most reliable if the sample of blood is taken about one to two hours after an intake of 50-100 grams of carbohydrates. The autoanalyzer is the most widely used instrument for diabetes screening. This automateal device provides quantitative readings on either whole blood or plasma specimens.

Researchers have made some progress in developing new technologies to treat diabetes mellitus. Gordon (1975) notes that biomedical researchers have developed an artificial pancreas. This unit provides a continuous monitor for blood glucose concentrations and a syringe with an indwelling needle or catheter activated by a small computer to deliver into the circulation very small increments of insulin based on minute-to-minute needs, to achieve normal glucose metabolism. A few years ago, Lacy et al. (1968) developed a method of preparing pancreatic islets free of other cellular elements for transplantation from a normal donor to a diabetic recipient animal. Rejection of the transplant comprises a quite formidable obstacle to the success of these efforts, and is associated with high mortality due to rejection of the organ and the need to use large quantities of immunosuppressive drugs.

VIII. Service Delivery

A number of services exist to aid the diabetic in participation "normally" in his society and community. These include:

1. The Vocational and Counseling Service established by the Diabetes Association. Physicians,trained social workers, and a psychologist are utilized by this service to provide guidance in career planning, not only for the well-motivated and regulated adolescent, but also for the poorly educated, the socially maladjusted, and the patient with complications (Kantrow, 1962, 1963).

The Service gives guidance to older diabetes as well. It maintains a close working relationship with other health and welfare agencies, but by working solely with diabetics it constitutes the only community agency that has the expert knowledge of diabetes essential to sound professional planning and service for the diabetic. The

Service guides the other agencies and has taken the lead in educating prospective employers in regard to the capabilities and dependability of diabetic employees. The focus is not only upon the psychologic adjustment of the individual and his family to the adjustment of the individual and his family to the demands of a chronic condition, but also upon assisting the diabetic to function effectively in the community.

2. State rehabilitation programs also aid diabetics, particularly those with the juvenile - onset type of disease. These started from World War II with a Federal Commission and Federal funds, although these funds are now administered by the states. The programs vary with each state, but the Massachusetts Rehabilitation Commission, for example, has provided funds for payment of tuition and other educational help for those diabetic children who qualify.

3. The passage of Second Injury Laws (Kornbeth, 1962, 1963) in over 45 states, has had a favorable influence on the hiring of diabetics because it has allayed some of the fears of employers concerning the cost of long-term disability. The laws vary from state to state, but all have the same basic objectives. They include provisions for assuming part or the financial burden when a person with a known disease or impairment is hired and then sustains a second injury or illness in connection with his work. If the original medical impairment prolongs the period of disability resulting from the second injury, the state will, after a waiting period, defray the compensation costs. By limiting the liability of the employee, this encourages the hiring of the physically handicapped. Lastly, these laws ensure an injured

employee of compensation for all the disability he incurs from an industrial accident.

4. Health Education Programs - An example of this type of program is the Diabetes Youth Family Program of Kansas (Smith, 1974). This program involves monthy seminars and discussion groups for children with diabetes mellitus and their parents. These programs are geared to keep the child and the family cope with the disease. Besides the monthly meetings a number of other activities are supervised by the center--for example, cooking classes for elementary and junior high school children; the development of weekend summer camps; recreational activities for children and their families; and a monthly newsletter.

5. Camps for juvenile diabetes - Summer camp programs have been valuable in implementing independence as well as giving the parents of diabetic children a hiatus from the constant responsibilities of diabetic care.

Camps teach diabetic children that they are most different. The camp programs serve as a form of group therapy for children with psychologic difficulties. The first camps were established in the 1920's and now there are 38 in the United States and 12 in Canada, and many in other countries, usually sponsored by local diabetes association. The camps are under the supervision of qualified physicians and the staffs include nurses and dietitians. In addition to full recreational programs, the children are given instructions about their disease.

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